AMERICAN MACHINIST

October 16, 1940

Turn on the Heat—*Manufacturers under pressure to speed up armament output turn to heat-treating and welding to improve their products*

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-120 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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VOLUME 84 — NUMBER 21

AMERICAN MACHINIST. Copyright 1940 by McGraw-Hill Publishing Co., Inc. Published every other Wednesday, price 35c. a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation. 330 West 42nd Street, New York, N. Y. Subscription rates—United States, Canada, Mexico and Central and South American countries $3.00 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions, 36 shillings per year, 72 shillings for three years. All other countries $6.00 a year, $12.00 for three years. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y. under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

PRINTED IN U.S.A.

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how

TO USE THIS ISSUE

IF YOU'RE GOING TO THE SHOW:

1. Read through the Show-in-Print section in detail, checking those items which you want to see and noting any questions in margins.
2. Check booths you intend to visit in the List of Exhibitors.
3. Use this issue as a preview and guide to the Show.

IF YOU'RE NOT GOING TO THE SHOW:

1. Look through the Show-in-Print—there may be so many items you want to know more about that you'll decide to go.
2. Check advertising pages for further detail.
3. Keep the issue as your permanent record of the Show.

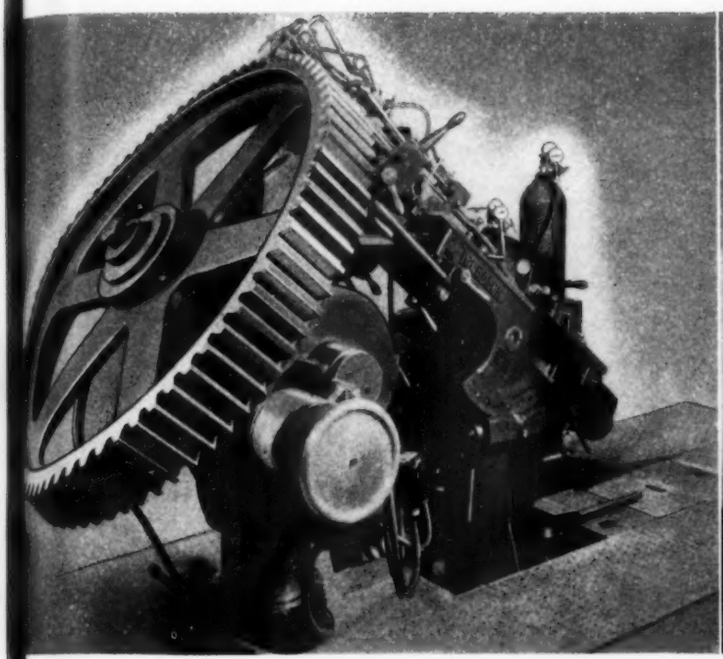
IN EITHER CASE:

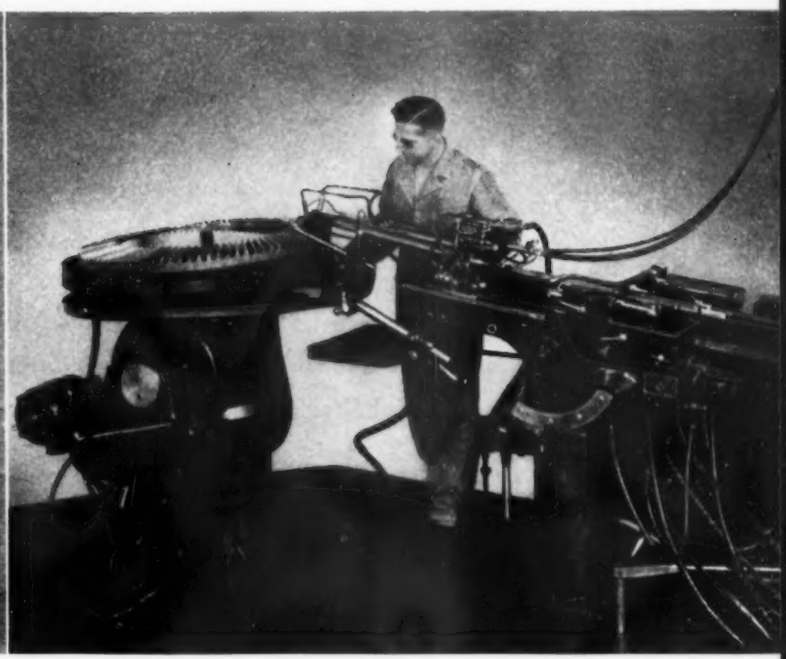
1. Read the special section on sheet steel—then mark it for filing.
2. Note carefully the record of new heat-treating and welding processes. Can you adopt—or adapt—any of the ideas pictured?
3. Preserve the issue as a working handbook—showing methods in the editorial pages, equipment and supplies in advertising pages.

THE ANNUAL METAL SHOW NUMBER of AMERICAN MACHINIST

Now GLEASON SURFACE HARDENING MACHINE

—FOR HARDENING LARGE GEARS WITH OXY-ACETYLENE FLAME—





A HARDENING MACHINE THAT IS . . .

✓UNIVERSAL

For straight bevel, spiral bevel, hypoid, spur, helical, and internal gears up to 100 in. diameter.

✓AUTOMATIC

Complete hardening cycle is automatic, hardening both sides of gear tooth at one time and uniformly hardening all teeth.

Hydraulic control permits automatic variation in speed of burner travel, producing uniform heating along entire length of tooth.

✓ECONOMICAL

The Gleason machine opens up a new field—the ***economical*** production of large gears with core toughness for shock and surface hardness for durability.

Operating costs—gas consumption included—are low.

AND HARDENS GEARS THAT ARE . . .

✓DISTORTION-FREE

Tooth bearing (area of tooth contact) as indicated on testing machine is the same after as before surface hardening on the Gleason machine.

✓HARD AND DURABLE

A hard (80 Scleroscope), durable tooth surface can be obtained by surface hardening.

✓SHOCK-RESISTANT

Automatic surface hardening, coupled with preliminary heat treatment of the gear blank to insure adequate core strength, results in an extremely tough and shock-resistant job.

Investigate the Gleason Surface Hardening Machine now!

GLEASON WORKS

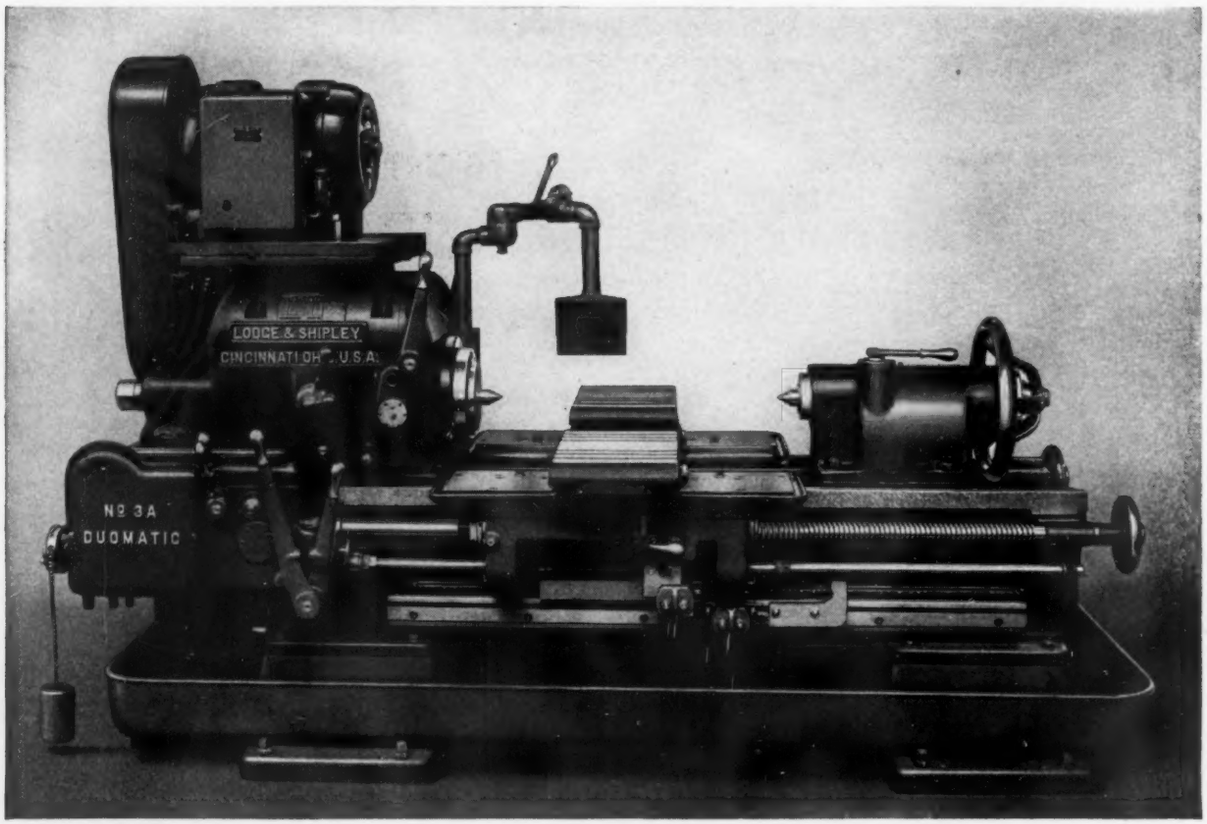
Builders of Bevel Gear Machinery for Over Seventy Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

PRODUCTION AND P
• • L. & S. LATHES HAVE B

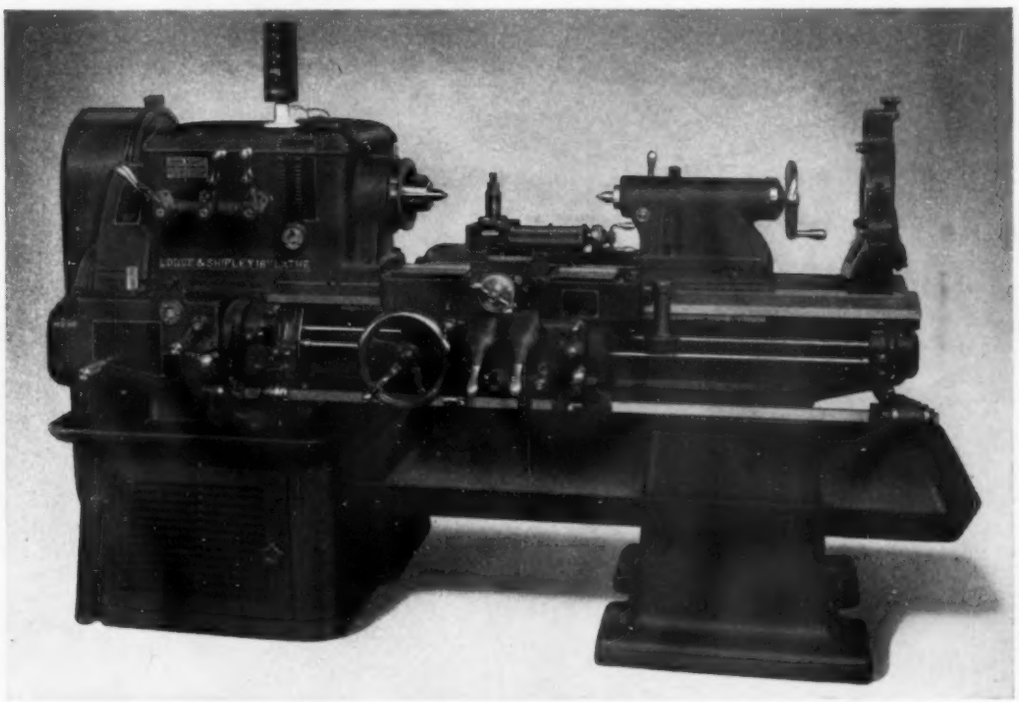
No. 3A Duomatic Lathe: The Duomatic Lathe is a fully automatic lathe providing independent front and rear carriages and tool slides. No cams or special attachments are necessary to obtain simultaneous or independent turning, boring, straight facing or angular facing cycles front or rear. By simple adjustments the desired cycle can be quickly obtained thus minimizing change-over time. A wide range of feeds and speeds are available. Profitable production of duplicate parts is not only assured but shops where the production is varied will find the quick change-over features a boon to small lot production.

VISIT OUR PLANT DURING THE AMERICAN SOCIETY OF TOOL ENGINEERS CONVENTION OCT-17-18-19 CINCINNATI, OHIO.



PRECISION BOTH

16" Selective Head Engine Lathe: The selective head lathe illustrated below has been especially designed for high-speed service. The twelve speed selective headstock powered by a two-speed constant horsepower motor provides twenty-four spindle speeds ranging from 18 to 1080 RPM. Simplicity has been the keynote in the construction of the entire lathe. Twelve spur tooth gears, two perfectly aligned hardened and ground multi-splined shafts and sleeves, plus ball bearing mounting and an automatic lubrication system comprises the entire headstock mechanism. Whether the job be one requiring unusually close limits of accuracy or one where speedy removal of metal is necessary, the lathe will provide an ease of operation which permits the operator to do far more work of a higher quality with less expenditure of effort.



THE LODGE & SHIPLEY MACHINE TOOL CO. CINCINNATI, OHIO

MORE JOBS

SPINDLE SPEEDS
200-E
514-D
222-C
95-B
41-A
CINCINNATI
SAVE WITH A CINCINNATI

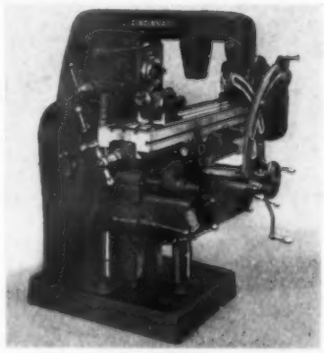
PER DOLLAR

WHEN you think of an unlimited variety of milling jobs in light and medium classifications . . . of tool room and manufacturing work of a jobbing character . . . think of CINCINNATI No. 2 L-Type Milling Machines.

They're just right for milling operations on *jigs and fixtures,* boring and drilling, as well as milling . . . *gages* of all kinds . . . *models* and components for special and new machines such as small firearms, business machines, etc. . . . *instructions* on milling work in vocational and training schools. An example of experimetal work is illustrated at the left —drilling an experimental fan housing, with the aid of the versatile CINCINNATI High Speed Universal Milling Attachment.

Here are the L-Type features which count so much in work of this kind. Twelve power feeds to longitudinal, cross, and vertical movements . . . quick feed changes from the front . . . power rapid traverse to longitudinal, cross, and vertical movements . . . fifteen spindle speeds up to 1200 r.p.m. . . . speed changes from front and rear . . . oil-shot lubrication for the knee, saddle, and table mechanism; automatic lubrication for parts in column.

For the maximum dollar value in a machine tool of this character, investigate the CINCINNATI No. 2 L-Type, either Plain or Universal styles. Circular M-719 will be sent to you on request.



The CINCINNATI No. 2 L-type used in tool rooms and shops for lighter class work. Built Plain and Universal styles.

CINCINNATI

A SYMBOL OF A DEFINITE STANDARD OF WORTH

THE CINCINNATI MILLING MACHINE COMPANY

CINCINNATI, OHIO, U. S. A.

With an eye – as well as

Because Jones & Lamson standard equipment and tools are designed to attain the greatest versatility of application with minimun change-over, Jones & Lamson Turret Lathes can do the largest variety of work without costly special equipment.

PROFIT PRODUCING MACHINE TOOLS

JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

MANUFACTURERS OF SADDLE & RAM TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . TANGENT AND RADIAL, STATIONARY AND REVOLVING DIES AND CHASERS.

on Tomorrow's Profits

Today's Expenses . . .

THE turret lathe that Jones & Lamson builds for you today is built to go right on earning profits for years to come.

Increasing production demands and the rapid development of faster cutting tools have made obsolete many a turret lathe that only a year or so ago was earning profits.

As an aid to prospective purchasers of turret lathes, Jones & Lamson have issued a book, "Turret Lathe Earning Power," that, in illustrated and concise form, gives factual answers to a dozen fundamental questions regarding turret lathe values.

This book is yours for the asking. Just fill in and send us the coupon below, and a copy will be sent to you.

Send the Coupon Today!

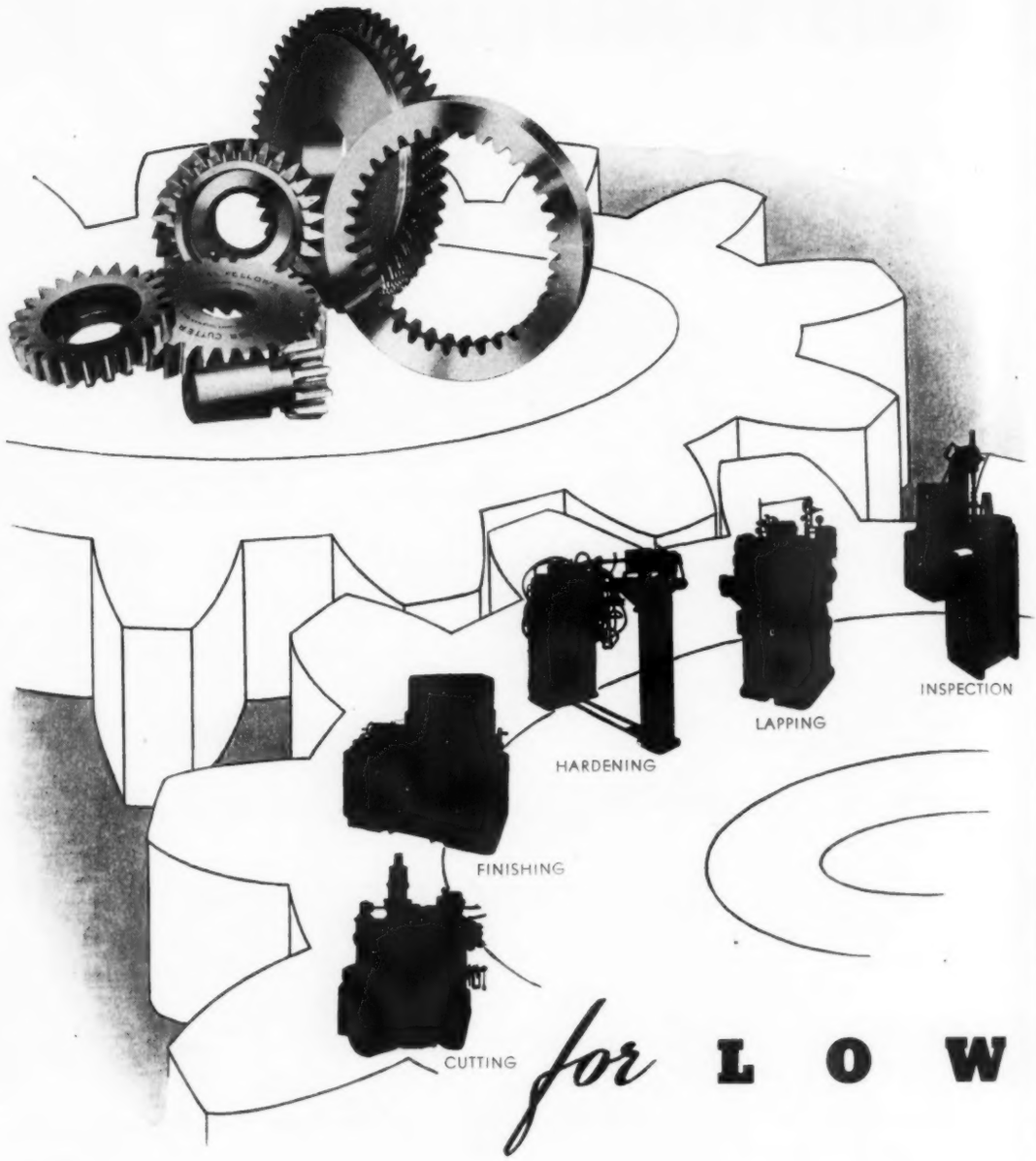
Please send me my free copy of "Turret Lathe Earning Power"

NAME _____

COMPANY _____

STREET _____

CITY _____ STATE _____



for **LOWE**

THE FELLOWS GEAR

BRANCH OFFICES:—

Geared-together

E R C O S T S

A primary advantage of the Fellows Method is that the successive operations: (1) cutting, (2) finishing, (3) hardening, (4) lapping, and (5) inspection are entrusted to machines of coordinated design. Each step is so perfectly integrated with all others that the over-all production cost, with a complete Fellows line-up, is exceptionally low . . . Ask to have one of our engineers explain how the Gear Shaper Method will lower your cost—no obligations will be incurred.

FELLOWS
Complete Line for Precision Gear Manufacturing

GEAR SHAPERS
RACK SHAPERS
COMPLETE LINE OF CUTTERS
THREAD GENERATORS
MASTER GEARS
LAPPING MACHINES AND LAPS
HELICAL CUTTER SHARPENERS
BURNISHING MACHINES
TESTING EQUIPMENT

R S H A P E R C O M P A N Y
78 River Street, Springfield, Vermont
616 FISHER BUILDING, DETROIT, MICHIGAN—640 WEST TOWN OFFICE BLDG., CHICAGO, ILLINOIS

It's pretty exciting to live in a world where things that can't be done are being done, where perfection is always being improved upon.

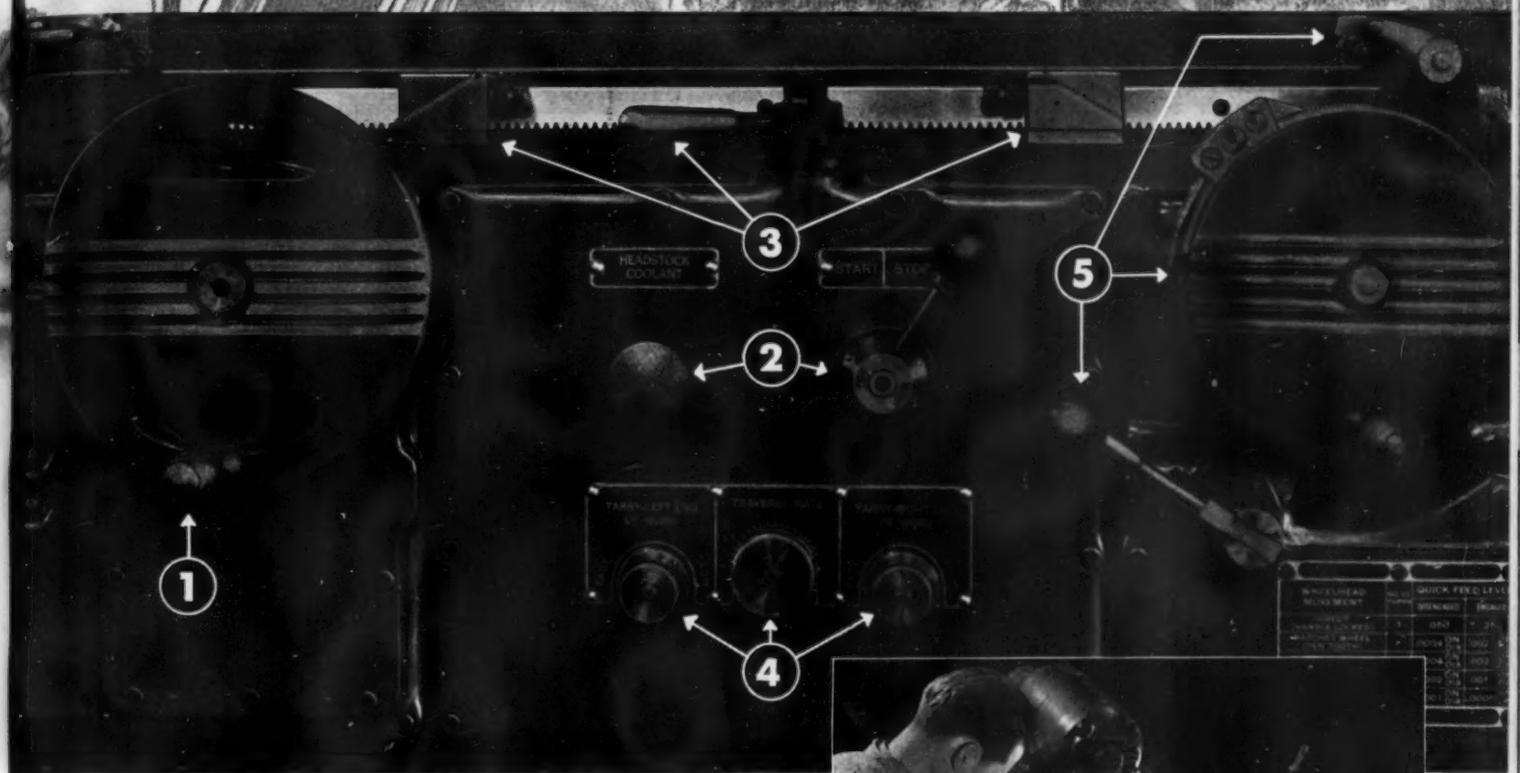
No one can keep up with it all. But you and the rest of us in industry know how scientific progress comes about. Today's "impossible" and "undreamed-of" inventions usually start in industrial laboratories.

We're mighty proud to enter the picture right there. New developments in machine tools are necessary before that new car, that new train, or even that tricky new gadget can go into production.

We produce Production—fast, accurate, dependable. Without it, inventions usually stay on paper. To produce better and better Production, the machine tool industry must continue to develop new equipment in its field, too—must apply tried principles in new and better ways found through alert research and proved with relentless factory and field performance.

A clear case in point is the CINCINNATI 12" Universal Hydraulic Grinding Machine. Exclusive features with a purpose—better production—add "speed" and "ease" to a machine whose basic design spells "accuracy" and "dependability". The result is **better grinding in your toolroom.**

Well THEY THINK UP MOTOR Next



Above: **Group portrait of Accuracy:** (1) two-speed table traverse handwheel which doesn't turn when power traverse is on, (2) coolant flow and work rotation start and stop automatically when power table traverse is started or stopped, (3) table traverse lever and quick-set dogs tooled for reversal accuracy within .004" at all traverse rates, (4) traverse rate and tarry controls **independent of each other**—different tarries at each end of table stroke if you want them, (5) rapid cross feed coupled with an infeed mechanism to reduce diameters in increments of .0001"!

Right: Let your hands hang naturally and they'll be right beside these sensitive controls. To the left you can see the speed ranger control which gives **infinitely** variable headstock spindle speeds between 55 and 500 r.p.m. And note the permanently mounted, hinged type internal grinding attachment swung up out of your way.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

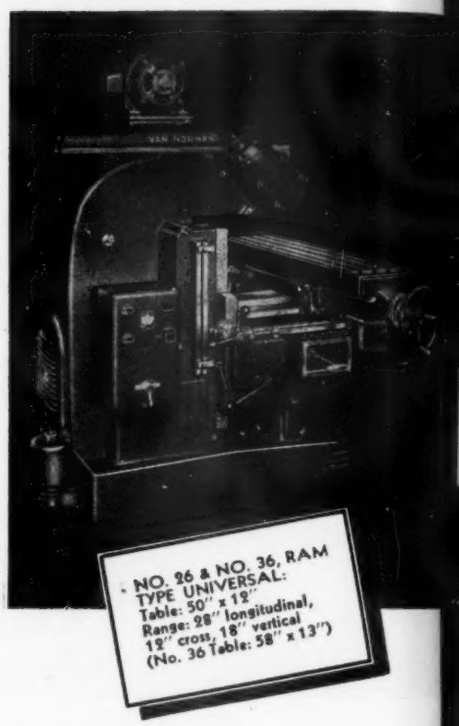
CINCINNATI, OHIO

14", 16", 20", 24", 28" Plain Self-Contained Grinding Machines.

Nos. 2, 3, 4 Centerless Grinding Machines. Centerless Lapping Machines. 6" and 10" Plain Hydraulic Grinding Machines.

12", 14", 16" Universal Grinding Machines.

VAN NORMAN builds this complete line of seven modern milling machines, each one designed to reduce job-time and errors, build up output and quality, simplify set-up and control, and provide smoother operation on the heaviest cuts. This line includes new models of the well-known Van Norman Ram Type Universal Millers, featuring the adjustable cutterhead and sliding ram which combine their adjustments to permit quick changes from vertical to horizontal to angular milling with a minimum number of reset-ups . . . with only the standard types of milling cutters and without attachments.



NO. 26 & NO. 36, RAM TYPE UNIVERSAL:
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical
(No. 36 Table: 58" x 13")

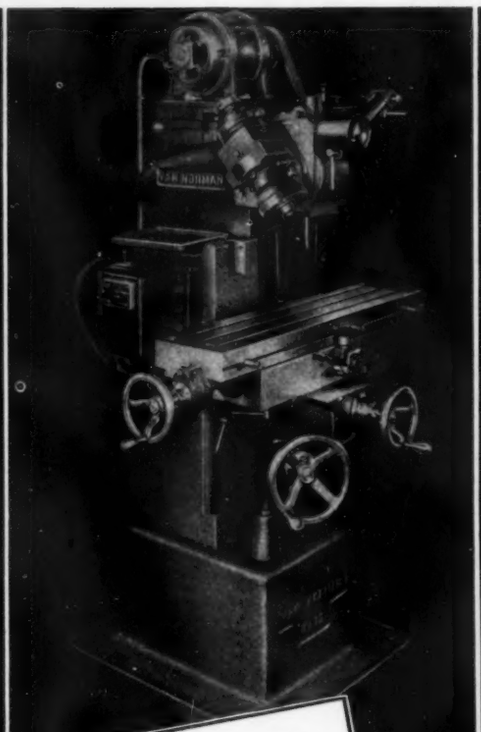
The line also includes Horizontal Plain and Universal Models . . . and the new Van Norman Handmill. To analyze the savings and improvements which these machines can bring to your work, write today for complete illustrated bulletins.

VAN NORMAN MACHINE TOOL COMPANY

Springfield, Massachusetts

VAN NORMAN MI

NO. 6 RAM TYPE UNIVERSAL:
Table: 30" x 18"
Hand Cross Feed: 5⅜"
Ram Movement: 9½"



NO. 12 RAM TYPE UNIVERSAL:
Table: 37" x 8⅛"
Feed Range:
17" x 6⅝" x 17"
Ram Movement: 12¾"

HAND MILL (PLAIN):
Table: 26" x 6"
Speeds: 160—1100 rpm
No. 40 Net. Std. Taper

NO. 2-L, PLAIN & UNIVERSAL:
Table: 45" x 10"
18 Speeds: 30—1450 rpm
12 Table Feeds: ½"—36"

NO. 22-L, PLAIN & UNIVERSAL:
Table: 45" x 10"
Range: 26" longitudinal, 11" cross, 16" vertical

NO. 2-S, PLAIN & UNIVERSAL:
Table: 50" x 12"
18 speeds: 25—1250 rpm
18 Feed Changes

I LLING MACHINES

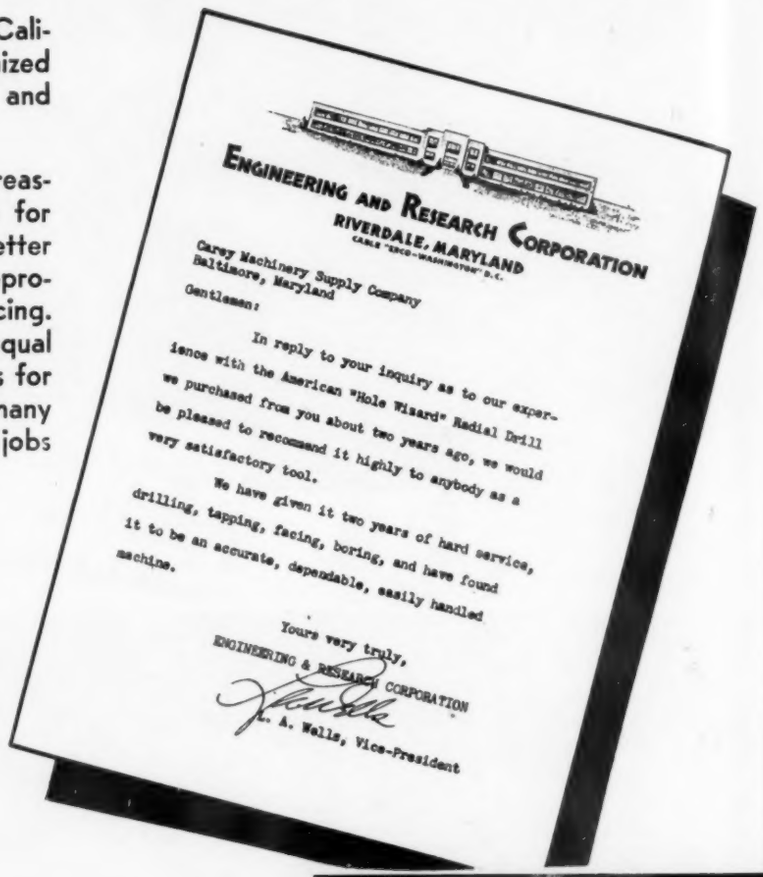
THE "AMERICAN" HOLE WIZARD

KNOWN FROM THE ATLANTIC TO THE PACIFIC

for versatility, power and accuracy...

From Farmingdale, Long Island to Alhambra, California, the "AMERICAN" Hole Wizard is recognized as a radial drill of exceptionally wide range and adaptability.

This "newest of new radials" is finding ever-increasing acceptance not only for drilling, but also for tapping, facing, boring (as evidenced by the letter from the Engineering and Research Corp. reproduced here) as well as counterboring and spot facing. Ability to handle all these operations with equal facility on the Hole-Wizard is one of the reasons for the almost constant use of this machine in the many shops where it is used. Time savings on these jobs add up so high that first cost is quickly repaid.



ENGINEERING AND RESEARCH CORPORATION
RIVERDALE, MARYLAND
CABLE "ERCO"—WASHINGTON, D.C.

Carey Machinery Supply Company
Baltimore, Maryland

Gentlemen:

In reply to your inquiry as to our experience with the American "Hole Wizard" Radial Drill we purchased from you about two years ago, we would be pleased to recommend it highly to anybody as a very satisfactory tool.

We have given it two years of hard service, drilling, tapping, facing, boring, and have found it to be an accurate, dependable, easily handled machine.

Yours very truly,
ENGINEERING & RESEARCH CORPORATION
J. A. Wells, Vice-President

EAST COAST: Boring with an "American" Hole Wizard at Seversky Aircraft Corporation at Farmingdale, Long Island, New York.

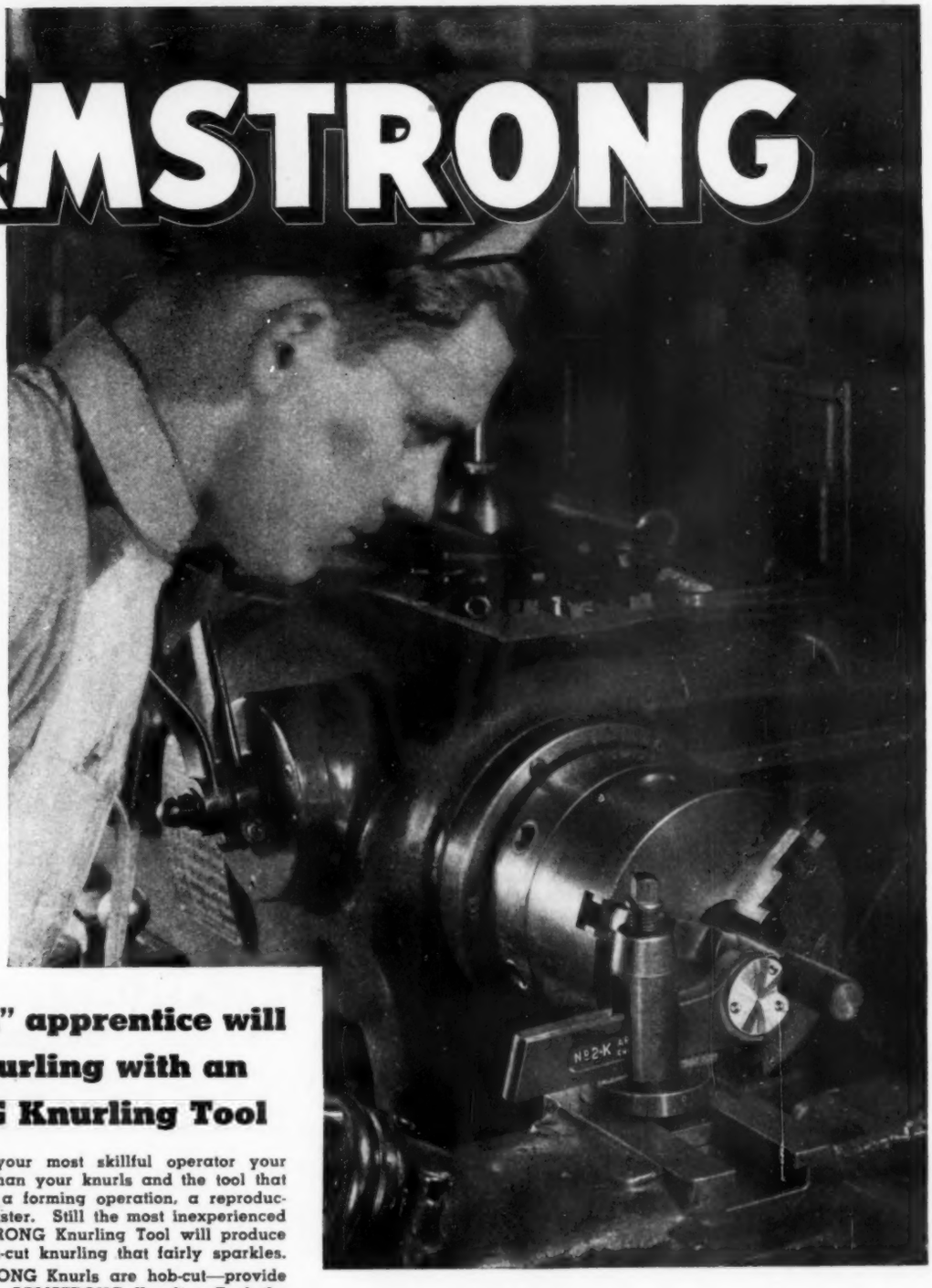
Get all the facts concerning the dividend-earning possibilities offered you in the "AMERICAN" Hole Wizard.

WEST COAST: Drilling operation on "American" Hole Wizard at Reliance Regulator Manufacturing Co. at Alhambra, California. »»

The AMERICAN TOOL WORKS CO

CINCINNATI, OHIO, U. S. A.

ARMSTRONG



Even a "green" apprentice will turn out knurling with an ARMSTRONG Knurling Tool

In the hands of even your most skillful operator your knurling can be no better than your knurls and the tool that holds them, for knurling is a forming operation, a reproduction of a pattern from a master. Still the most inexperienced apprentice with an ARMSTRONG Knurling Tool will produce uniform, fully formed, clean-cut knurling that fairly sparkles.

This is because ARMSTRONG Knurls are hob-cut—provide a clear cut master. In an ARMSTRONG Knurling Tool the pressure on matching knurls is always uniform; is automatically equalized because the tool itself is self centering. The alignment too, is rigidly held, and knurls "track" exactly no matter how engaged for the large knuckle joint of this tool has sufficient strength and bearing on the shank (315°) to absorb not only end thrust but any side strain or torsion.

ARMSTRONG Hob-cut Knurls come in both "straight" and "diamond" patterns, each in "fine", "medium" and "coarse". ARMSTRONG Knurling Tools come in 5 sizes. With knurls instantly interchangeable each effectively equals a complete set of knurling tools. Standardize on ARMSTRONG Hob-cut Knurls and ARMSTRONG Knurling Tools and your knurling problems will disappear. You can get them from stock at any Mill Supply house.

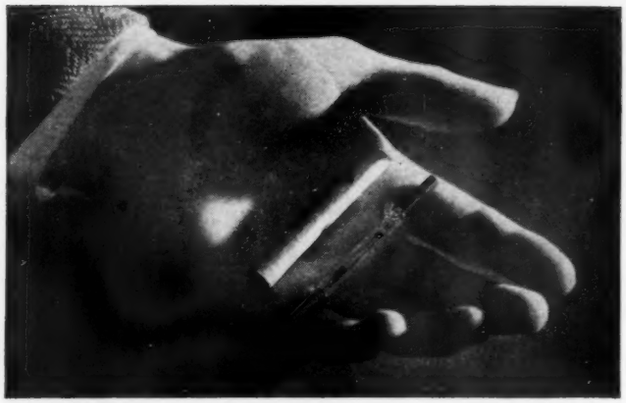
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

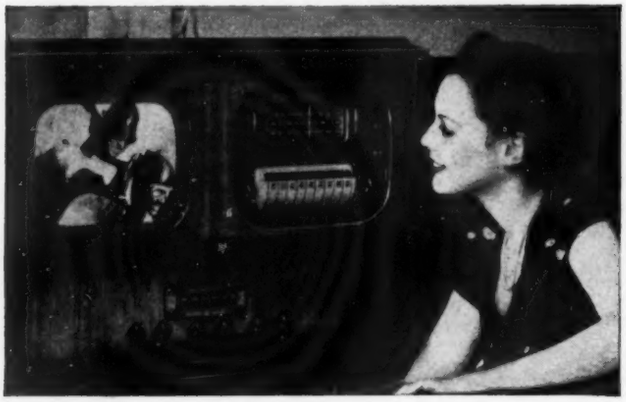
ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

No bigger than a cigarette

1/5 AS BRILLIANT AS THE SUN!

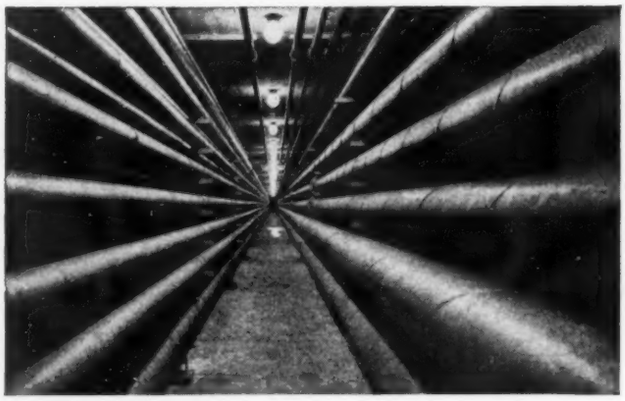


1 THE EARTH ITSELF IS A MIDGET compared to the sun. But this amazing new G-E "Midget Sun", 1/5 as bright as the sun's surface, is no bigger than a cigarette! A 1000-watt water-cooled mercury lamp, made of special quartz glass, it already has many practical uses, for instance . . .



2 . . . IT HELPED BRING TELEVISION "out of the laboratory" by supplying higher levels of lighting, previously impracticable at close quarters, thus making televised images clearer. It is also used in photo-enlarging, engraving, and blue-printing. Is there a place in your business for this "Midget Sun"?

3 BETTER LIGHTING helps step-up increased production schedules. The Lees-Bradner Machine Tool Company in Cleveland gets 27 footcandles by using 500-watt G-E MAZDA C (filament) lamps in modern fixtures. Ask your G-E lamp man or your electric service company about better light for your plant.



4 STARTING WITH THOMAS A. EDISON, General Electric research has constantly been finding ways to make G-E MAZDA lamps give more light for current consumed. Use of argon gas (carried in pipes above) was a great forward step. Other improvements have increased lamp efficiency nearly 50% since 1921 . . . another reason for buying G-E MAZDA lamps!

HOW TO GET THE KIND OF LIGHTING YOU NEED . . . EASILY AND ECONOMICALLY!

Although you may never have occasion to use the G-E "Midget Sun" described above, General Electric makes many other kinds and types of lamps to give your business better light for better seeing at lower cost than was ever before possible.

Different kinds of work require different types of lighting and varying amounts of light. Your G-E lamp man or your electric service company can show you how to get the lighting you need . . . easily and economically with G-E MAZDA lamps.

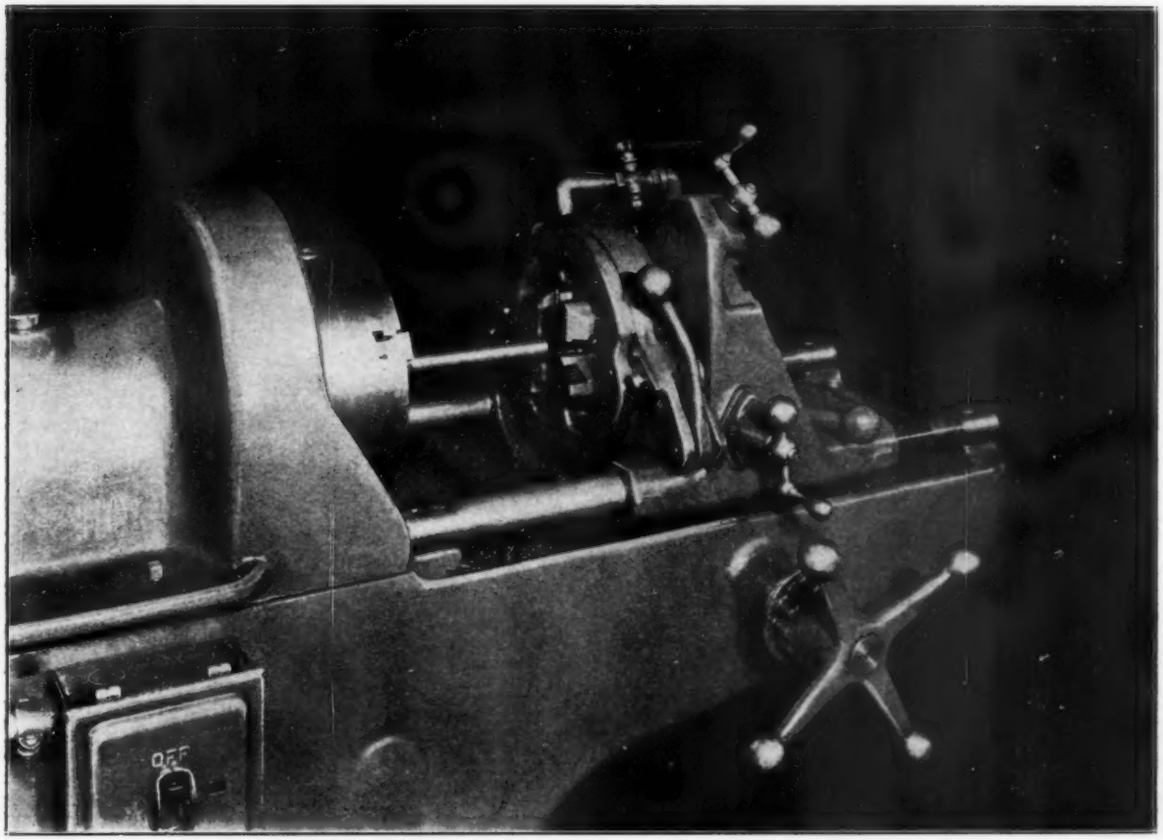
For helpful information on how better lighting can improve your business, write General Electric Company, Dept. 166-AC-J, Nela Park, Cleveland, Ohio.

The general offices of the Borg and Beck Division of Borg-Warner Corporation in Chicago are well lighted with 76 fixtures each containing four 40-watt G-E MAZDA daylight fluorescent lamps. Illumination on the desks is 35 footcandles.

G-E MAZDA LAMPS

GENERAL ELECTRIC

Year by year, better lamps for every purpose



Little LANDIS

unexcelled for

Jobbing and Maintenance Threading

The Little LANDIS provides an efficient and an economical means for cutting either straight or tapered threads at a minimum cost.

One west coast manufacturer employs the little LANDIS for threading spring clips. These clips are made from mild steel. The threads are 1" diameter, 14 pitch N. F., 5" long. There are two threads to each piece of work.

Even though the threads must be held to close tolerance specifications the little LANDIS produces 100 clips for a total of 1000 inches of thread per grind of the chasers. Threading cost must be low.

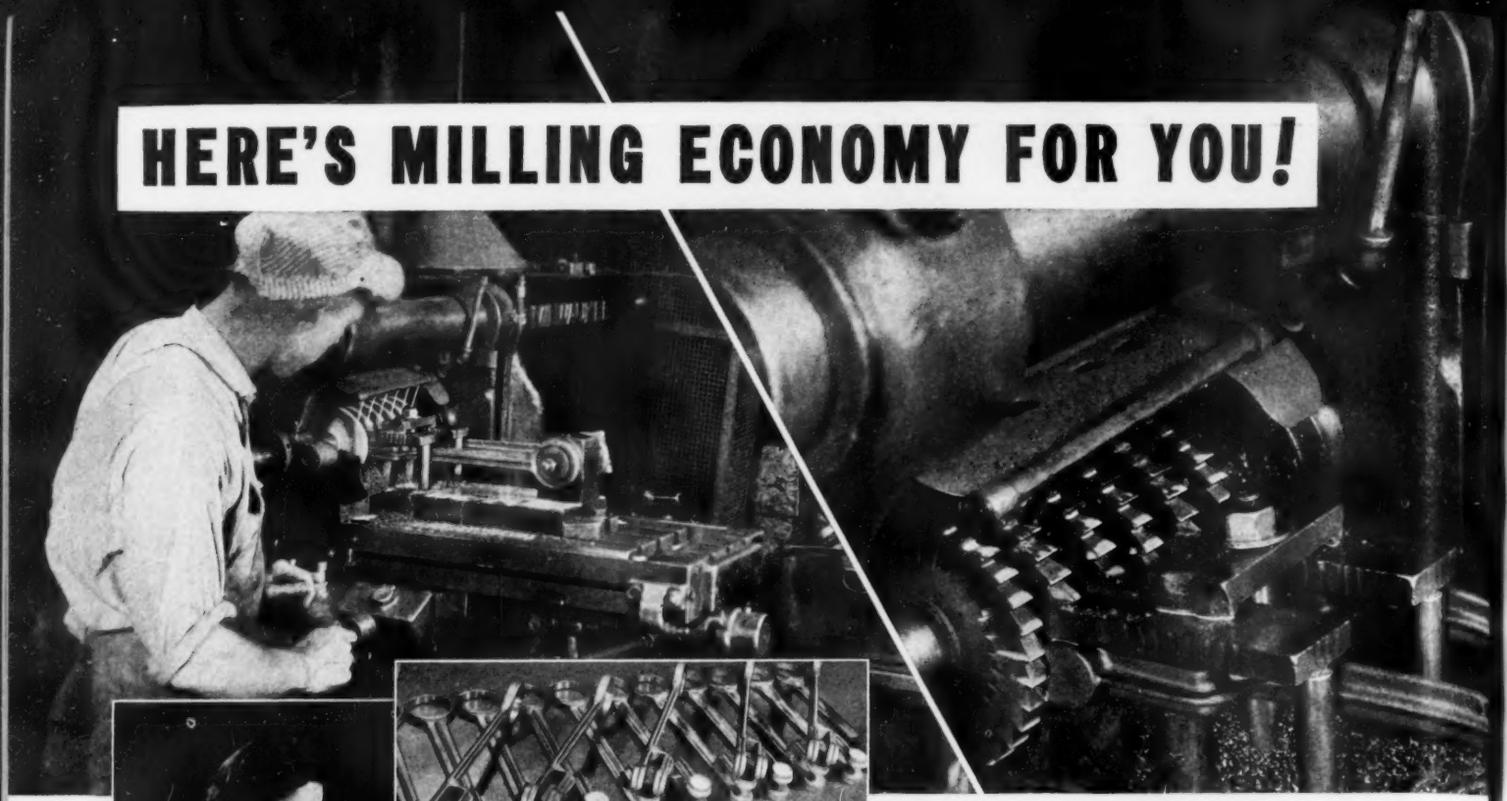
Consider using the Little LANDIS for your Jobbing and Maintenance Threading operations. Its use assures Lower Threading Cost.

Write for Bulletin No. C 82-2

LANDIS MACHINE CO., Inc.
WAYNESBORO, PENNA.

LANDIS

HERE'S MILLING ECONOMY FOR YOU!



The new Maytag Master Washer with 50% greater washing capacity.

TOTAL CUTTER LIFE
1,350,000 PIECES
FROM THIS GANG OF
BARBER-COLMAN "PARAFORM" CUTTERS

Production figures from many plants prove that Barber-Colman "Paraform" Cutters produce low cost, accurate milling. At the Maytag Company, a gang of two interlocking and four double Barber-Colman side mills machine two pitman rods at a time. Stock removed is approximately 1⅝" diameter by ⅛" deep; floor-to-floor time 55 seconds per pair. Between grinds these Barber-Colman Cutters produce a total of 9000 pieces. The interlocking cutters have a life of approximately 150 sharpenings, and produce about 1,350,000 pitmans. The double side milling cutters which are reversed and used on both sides last even longer. You'll find an equally profitable answer to many a tough milling problem by using Barber-Colman Complete Cutter Service. Memo: *Send next cutter order to Barber-Colman with a blueprint of the job.*

Quick Job Figures

Name of Part — Pitman for center drive of Maytag Washers.

Material — Malleable iron.

Operation — Milling bosses on yoke ends of pitman rods; two at a time. Each boss is milled to 0.755" — 0.745" thickness; distance between bosses held to 0.699" ±0.001".

Cutters — 6 Standard Barber-Colman "Paraform" Cutters. Each set of the double gang consists of a 5¾" diameter interlocking side mill mounted between two double side milling cutters.

Machine — Milwaukee Mill.

Holding — Special locating fixture.

Stock Removed — ⅛" on each of eight round bosses, 1⅝" diameter.

Feed — 5" per minute.

Speed — 55 revolutions per minute.

Production — 2 pitmans are milled in 55 seconds, floor-to-floor; more than 130 complete pieces an hour.

Pieces per Grind — 9000 pieces per gang; with a total life of approximately 150 sharpenings = 1,350,000 pieces per gang.

Remarks — When the double side mills become dulled on one side, they are transposed, using the other side. After sharpening the interlocking mills, they are shimmed to restore the correct slot width. Cutters are resharpened until the original 5¾" diameter is reduced 1½" or to 4¼" diameter.

● Catalog K tells all about Barber-Colman "Paraform" standard and special cutters; is full of useful information on milling, cutter sharpening, reamers, and hobs. Write for your copy today. Be sure to give the name of your company.

BARBER B-C COLMAN

PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

General Offices and Plant 201 Loomis St., Rockford, Illinois, U. S. A.

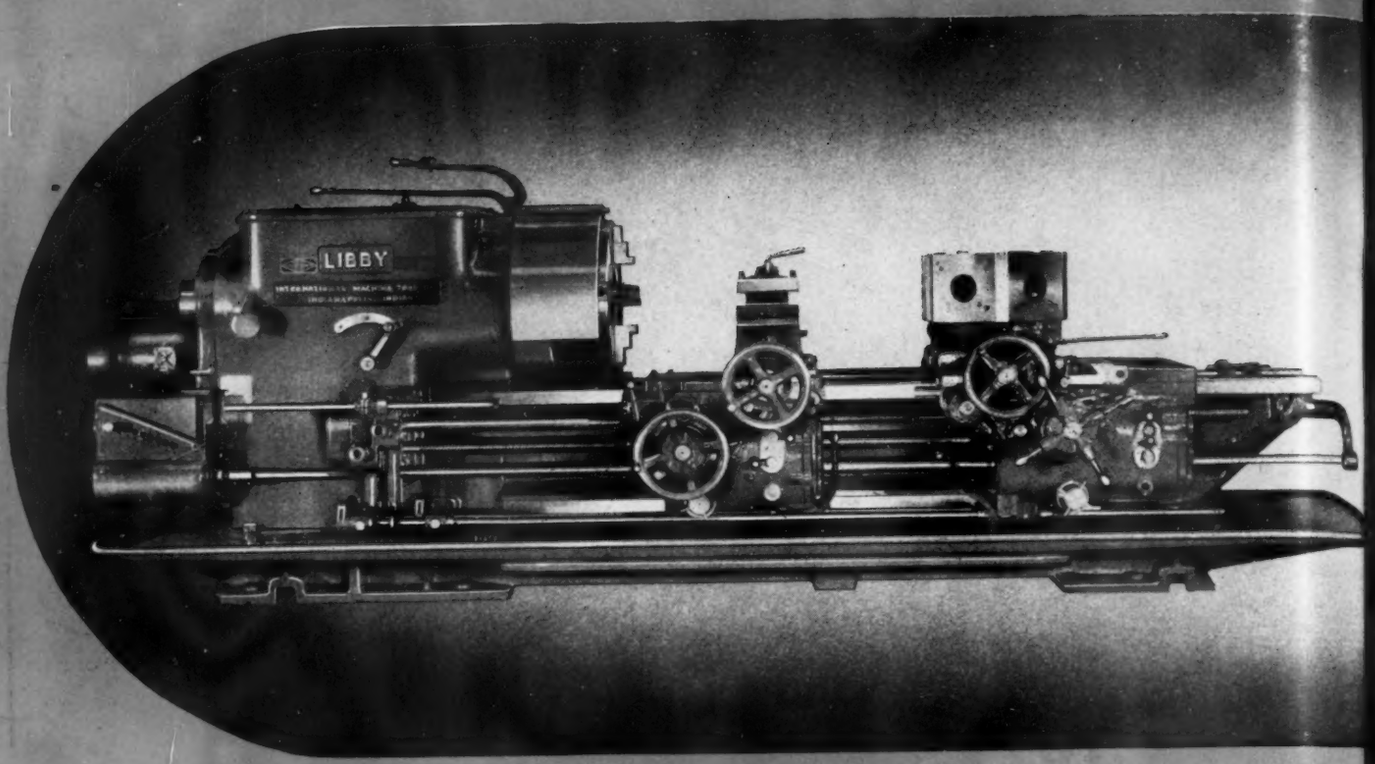
Grind Knuckle Pin Holes on BRYANT Internal Grinders ... in one set-up

THE Bryant No. 16-38" Hydraulic Hole Grinder, with special holding fixture, has proved the ideal machine for cutting the cost of grinding knuckle pin holes in aircraft engine, master connecting rods. Vital accuracy is obtained by means of an interesting indexing and holding fixture.

A centering plug in the work spindle accurately aligns the hole in the grinding position. The back knuckle pin holes in the connecting rod are .005" smaller than the front holes, yet the Bryant method of using a positive stepped guide for the wheel head completely eliminates inaccuracies, and automatically maintains the difference in size of both the holes. The Bryant method of using one wheel eliminates unequal wheel spindle deflection, uneven wheel and diamond wear, and sizing errors encountered by the two-wheel method. The sixteen holes in this rod are ground in approximately 40 minutes, floor to floor.

Bryant is prepared to help others prepare in the program of national defense. Increased plant facilities plus experience on thousands of internal grinding jobs are your assurance of prompt attention and complete satisfaction.

BRYANT
CHUCKING GRINDER COMPANY


LIBBY

LIBBY TURRET LATHES

Versatility • Precision • Convenience

ON HEAVY DUTY JOBS

The manufacture of oil well equipment is one of the best tests of a lathe's ability to perform efficiently on a wide variety of large, heavy duty jobs. The National Supply Co. of Toledo, manufacturers of oil well supplies, has been a user of Libby Turret Lathes for over thirty years. One of the ten Libby Lathes in their plant is shown below, turning, boring and facing oil well casing shoes. On jobs like this, Libby Lathes combine Flexibility, Versatility and Convenience with consistent accuracy and high production under the most difficult conditions.

Our large staff of engineers and production executives will give prompt attention to your inquiries. Let us give you our engineering recommendations for greater efficiency on your heavy duty turret lathe jobs.

Prompt service to present users of Libby Lathes. Early deliveries to prospective buyers.

CMC
CLEARING
Libby
TURRET LATHES

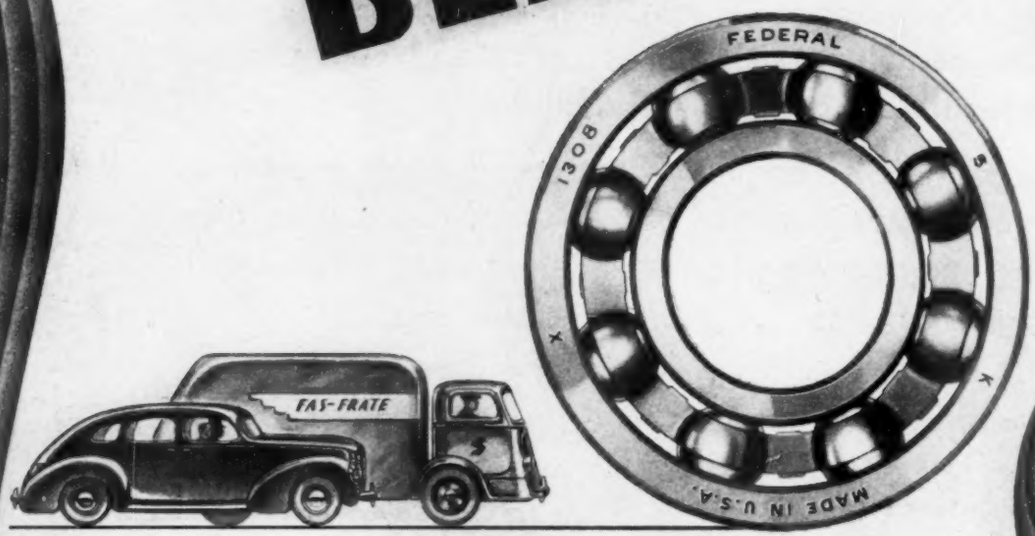
INTERNATIONAL MACHINE TOOL COMPANY, Inc.

INDIANAPOLIS INDIANA

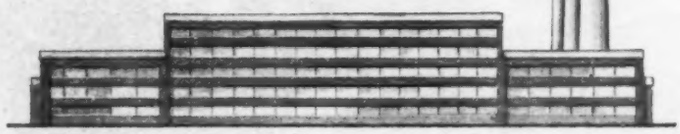
Subsidiary of

CLEARING MACHINE CORPORATION, CHICAGO

FEDERAL BEARINGS



TRADE MARK

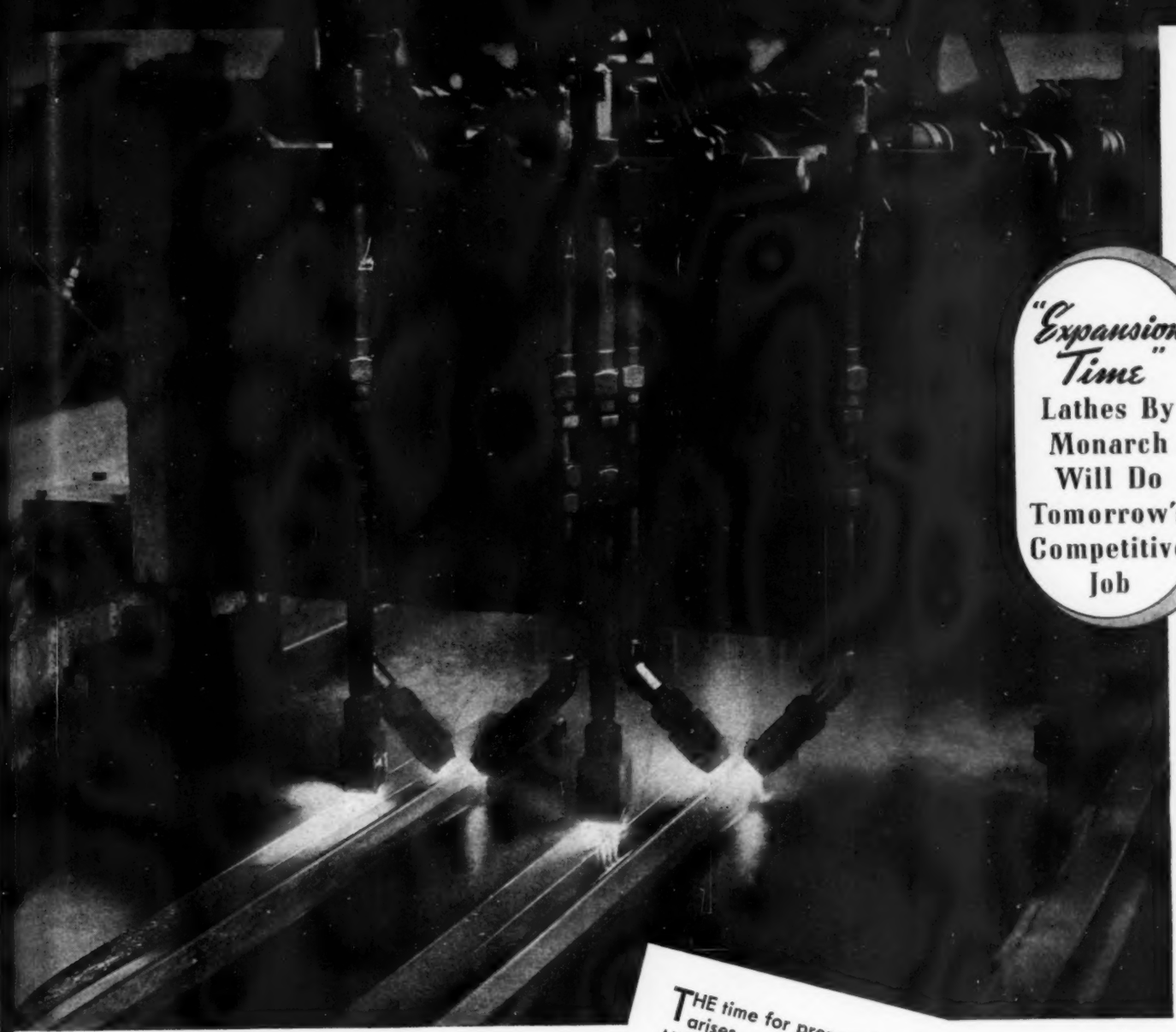


THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

Detroit Sales Office: 2608 Book Tower • Chicago Sales Office: 902 S. Wabash Ave.
Cleveland Sales Office: 402 Swetland Building



"Expansion Time"
Lathes By Monarch Will Do Tomorrow's Competitive Job

WHY RESEARCH
AT A TIME LIKE THIS?

THE time for preparedness is BEFORE the emergency arises . . . not AFTER. That's why, for many years, MONARCH has maintained a policy of constant, unrelenting research. From the crucible of MONARCH research have come many of the greatest improvements in modern lathe manufacture . . . notably, the exclusive "Flame Hardening" process.

This development hardens the bed way surfaces of lathes after planing, by subjecting them to intense heat from oxygen-acetylene burner tips in a special "Flame Hardening" water tank. The depth of the hardened portion is a minimum of ⅛" and can be made ¼" or more. The grain structure of the entire hardened portion is greatly refined and condensed, while the dense, close-grained metal directly under the hardened portions, gives a rigid support. The "Flame-Hardening" process insures against bed wear, scoring, inaccuracy and shortened life . . . helps industry advance a step farther toward its ultimate goal of producing "More Goods For More People, At Lower Cost." The Monarch Machine Tool Company, Sidney, Ohio.

MONARCH LATHES

Tool-up with Monarch!

BROWN & SHARPE ELECTRICAL CONTROL

BROWN &

—FOR RAPID AND PRECISE MILLING

An instance of *Electrical Control* pioneered by Brown & Sharpe—the No. 12 Plain Milling Machine.

Outstanding for —

- – – RAPIDITY AND PRECISION OF MOVEMENTS of both table and spindle
- – – FLEXIBILITY OF PERFORMANCE gives maximum efficiency on both long and short run work
- – – WIDE CHOICE OF MILLING CYCLES
- – – SMOOTH AND QUIET OPERATION
- – – CONVENIENT ADJUSTMENTS for fast, easy set-up
- – – SAFETY PROTECTION for both machine and operator
- – – CLIMB MILLING for efficient milling of pieces usually difficult to hold
- – – DEPENDABILITY AND LASTING ACCURACY

B·S

Operators find Electrical Control requires minimum effort and gives greater production—particularly worthwhile on fast jobs like that shown at the left.

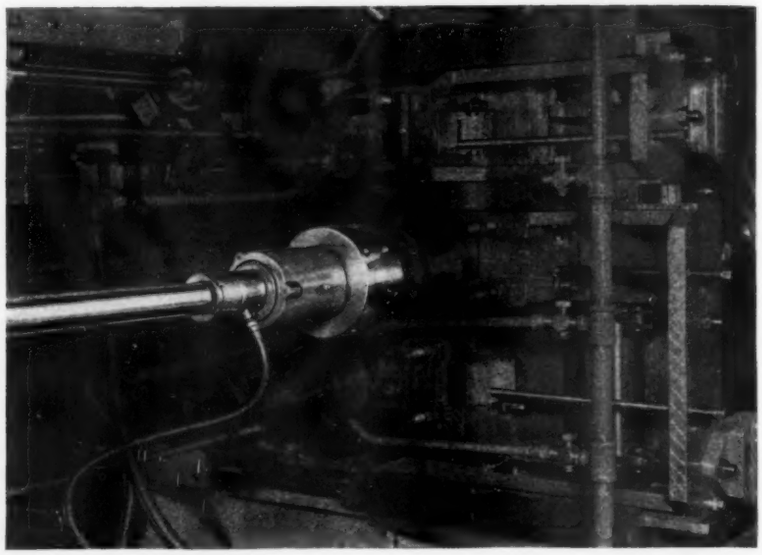
Ask for complete details of Electrical Control on Brown & Sharpe Milling, Grinding and Screw Machines.

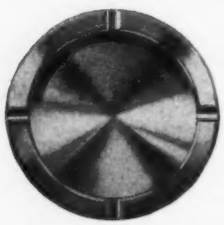
Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

SHARPE

Cross-Mill, Cross-Drill & Stamp

without stopping the spindle!





CROSS-MILLING

CROSS-DRILLING

STAMPING

This Cone engineering achievement opens an entirely new field of profit possibilities — it eliminates other machines and other operations, saves floor space, reduces labor costs, and simplifies many designing problems.

This standard attachment permits taking cross-milling cuts no matter what the speed of the spindle; not only may cross-drilling be accomplished, but the holes may be drilled at any predetermined point on the length and circumference of the work; marking may be die stamped on the end of the work without stopping the spindle.

Let us estimate the savings on similar jobs for you — this new attachment may save thousands of dollars on a single job. Write Cone today.

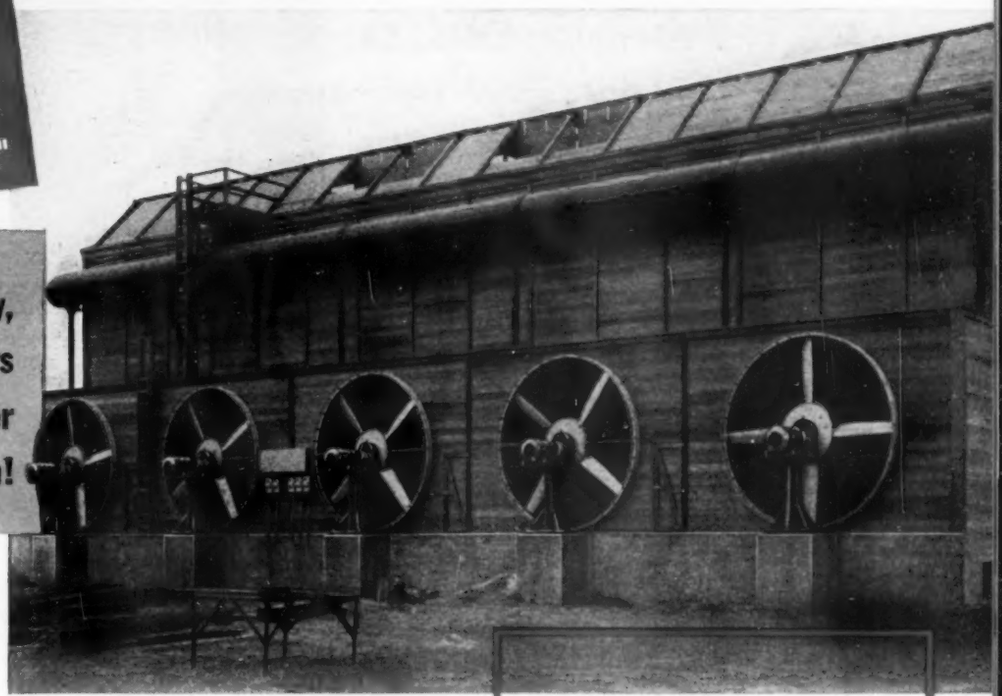
CONE AUTOMATIC MACHINE CO., Inc.

WINDSOR, VERMONT, U. S. A.

MAKES A CYCLONE WITH ALLIS-CHALMERS MOTORS!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Panhandle Power & Light Company, Borger, Texas, Finds Allis-Chalmers Lo-Maintenance Motors the Answer to a Tough Operating Problem!



MAKING a man-made cyclone to cool 15,000 gallons of water per minute is a job in itself . . .

But when it has to be done outdoors in all kinds of Texas Panhandle weather — in heat . . . in rain and dust storms . . . then you've got a situation that calls for motors that are *better* than ordinary.

Recently when the Panhandle Power & Light Company put in a Foster Wheeler cooling tower at Borger, Texas, they knew they were up against a tough operating problem. Here's how they solved it —

They went to their own customers in the carbon black industry where motor conditions were notoriously severe . . . found *one* motor in general use. And that motor, they discovered, to be the Allis-Chalmers dust-proof, weather-proof Lo-Maintenance Motor!

That's why they selected these same motors . . . why today they can snap their fingers at all the hazards of outdoor motor service in the Texas Panhandle. And best of all — they know they'll continue to get low-cost, dependable service for many years to come.

THE PANHANDLE POWER & LIGHT Company heard amazing stories from their customers about the performance of Allis-Chalmers Lo-Maintenance Motors. That's why they chose these same motors to power the four-bladed axial flow fans in their new cooling tower . . . where 15,000 gallons of water per minute are cooled from 105° to 90°F.

Cut Your Power Costs With Lo-Maintenance Motors!

For Allis-Chalmers Lo-Maintenance Motors are built with extra-value construction to give performance that's more than just their nameplate ratings. These motors are outstanding in having high carbon steel frame . . . indestructible rotor . . . distortionless stator . . . plus Allis-Chalmers famous no-stint policy in materials and workmanship!

Whether you have difficult or easy motor jobs, it will pay you to use Lo-Maintenance Motors. The trained engineer in the district office near you will be glad to tell you how you can cut power costs. Call him today. Or write Allis-Chalmers, Milwaukee.

A 1287

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

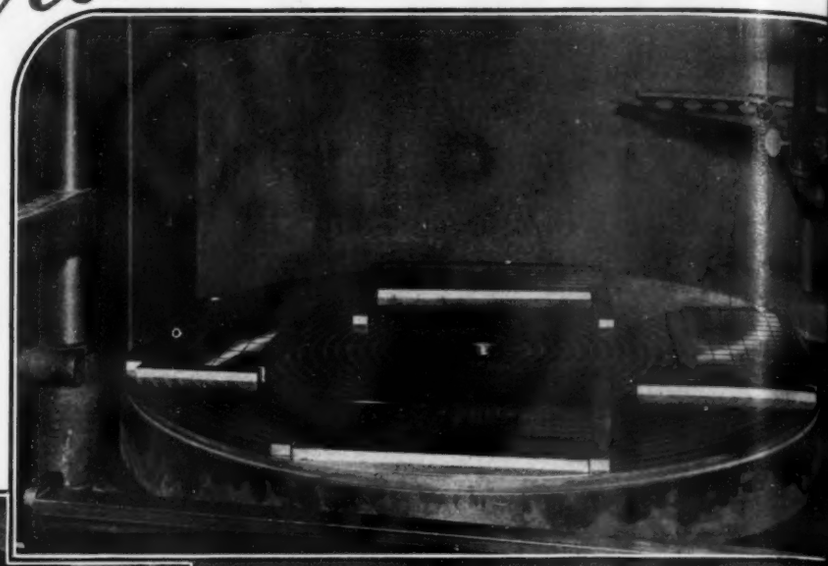
A-C

ALLIS-CHALMERS

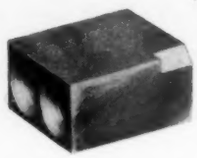
MILWAUKEE · WISCONSIN

Blanchard GROUND —

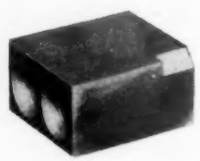
The two Blanchard No. 18 Grinders produce 1000 complete blades every 8 hours



The sides of the blades are ground parallel within .00015" on the chuck of the No. 18 Blanchard.



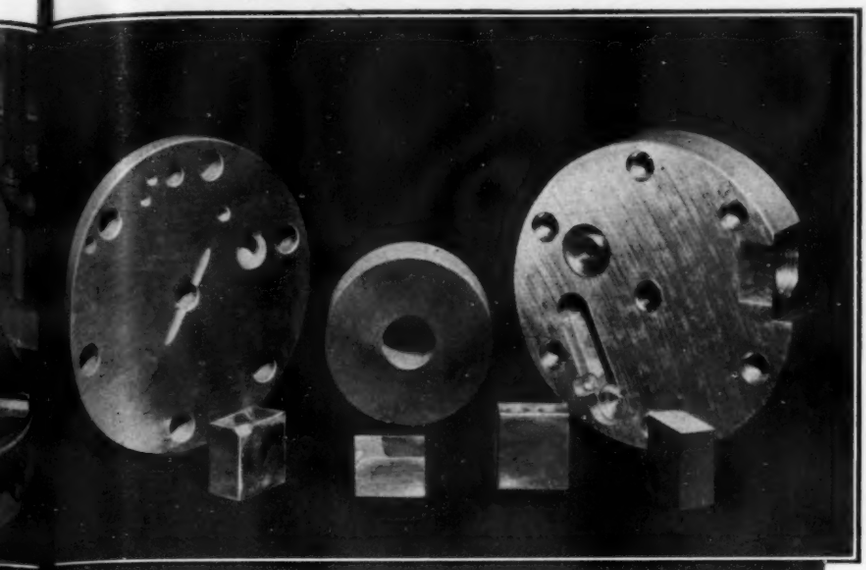
The first ends of the blades are ground square with the sides within .0001" in fixtures designed and built by Blanchard.

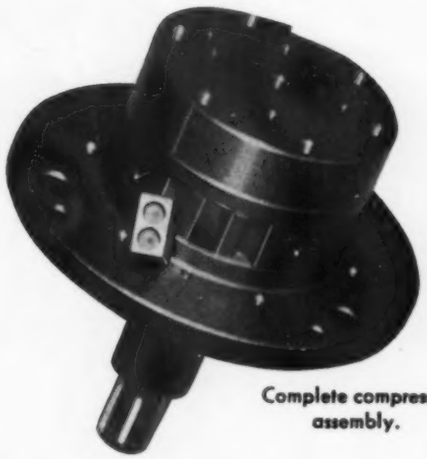


The opposite ends are ground with the blades still in the fixtures but resting directly on the chuck, square within .0001" and parallel with the first end within .00015".

BLANCHARD **THE BLANCHARD MACHINE COMPANY**

SQUARE WITHIN .0001"





Complete compressor assembly.

At left — end plates, roll, and blades are all Blanchard Ground.

. . . And here's how

One of the finest quality jobs done by production manufacturers today is the machining of the blade used in electric refrigerator compressors. Two Blanchard No. 18 Surface Grinders with Blanchard designed and built fixtures are used to grind all six surfaces of all the blades produced by one of the largest of these refrigerator manufacturers.

The following Blanchard Grinder operations are performed on the blades:

FIRST — 360 blade blanks are held on the chuck at one time while one side of the blades is being ground.

SECOND — The blades are turned over and ground parallel within .00015".

THIRD — The blades are then placed in six 10-station fixtures mounted on special locating plates on the chuck. One end of the blades is ground.

FOURTH — The fixtures are turned over and the blades rest directly on the chuck while the opposite end is ground.

FIFTH — One edge of the blades is ground in the same manner as the third operation.

SIXTH — The fixture is turned over and the opposite edge ground as in the fourth operation.

After each operation a Blanchard Demagnetizer is used to demagnetize the work and the fixture.

The blades are not only held parallel to .00015", but every surface is square with every other surface within .0001". After grinding the blades are lapped, still in the same fixtures.

The two Blanchard No. 18 Grinders produce 1000 complete blades every 8 hours.

No. 18 Blanchard Grinder

64 State Street, Cambridge, Mass.

Two ways to SAVE MONEY IN YOUR PLANT

1. RECLAIM UP TO 98.6% OF OIL ON YOUR METAL CHIPS
2. REDUCE TOOL WEAR

Removable "basket" is loaded with oily chips and placed in wringer. After wringing operation the "basket" is lifted out and chips dumped. Recovered oil flows from outlet to tank or containers.

TOLHURST Chip Wringers give you the highest percentage of cutting oil recovery obtainable with any type of equipment. These money-saving oil recoveries are accomplished by utilizing centrifugal force. No steam is used, thereby eliminating any loss of oil through emulsification. Operation is simple and *safe*—unskilled operators can run them efficiently.

Tool room records of TOLHURST users show that tool wear is reduced as much as 50%. This additional savings results from having a plentiful supply of clean, reclaimed cutting oil that can be used generously on machine tool operations. TOLHURST Chip Wringers are available with 20″, 26″, 40″ and 48″ baskets.

Decide now to investigate TOLHURST Chip Wringers for saving money in your plant.

Get complete details and latest prices. Use the handy coupon below. *Mail it today!*

TOLHURST CHIP WRINGERS

TOLHURST CENTRIFUGAL DIVISION
American Machine and Metals, Inc.
104 Tolhurst St., East Moline, Illinois.

Yes

Without obligation, send me FREE details and latest prices on ☐ Tolhurst Chip Wringers; ☐ Tolhurst Centriforce Washers.

Name .....

Firm Name .....

Address .....

City ..... State .....

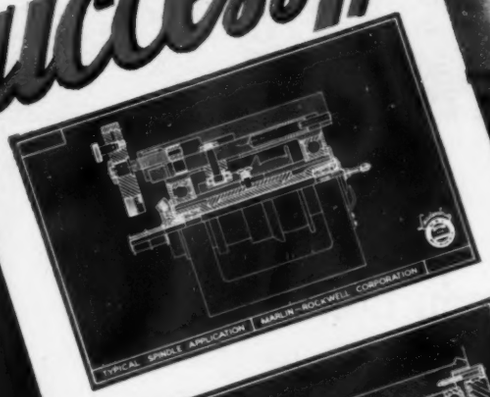
New TOLHURST CENTRIFORCE WASHER for small machined parts

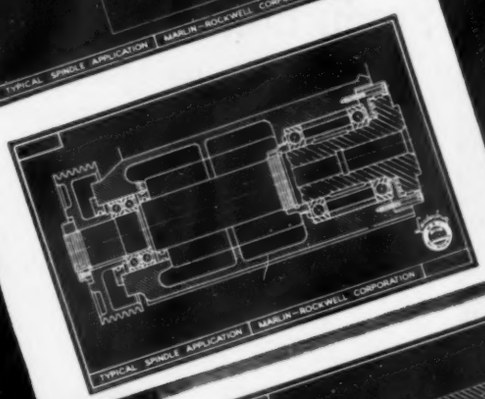
washes – rinses – drys –

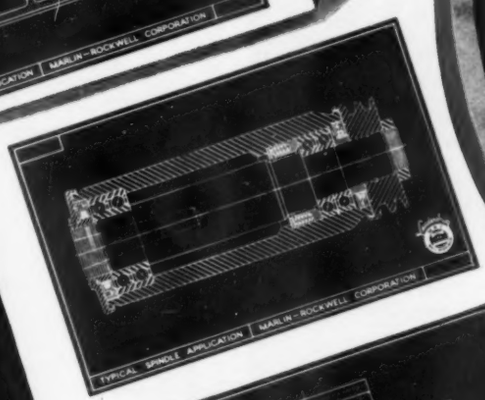
WITHOUT INTERMEDIATE HANDLING

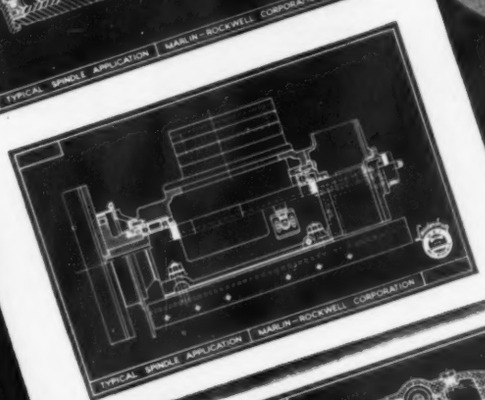
Washes screw machine parts with hot detergent solution removing oil, grease, dirt and fine chips. Rinses parts after washing, removing detergent. Completely dries parts (with or without use of hot air blast). Your finished product comes from the machine clean and dry, ready for assembly or packing. Get FREE details. Use the coupon at left.

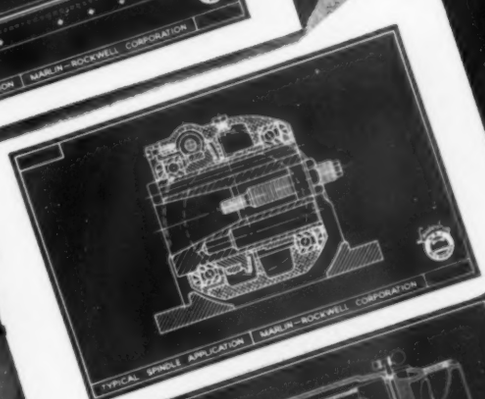
Successful MACHINE TOOL SPINDLES

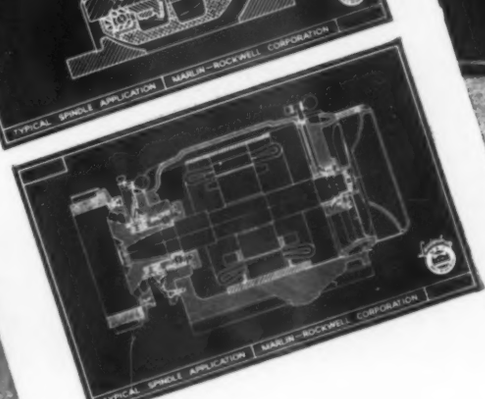


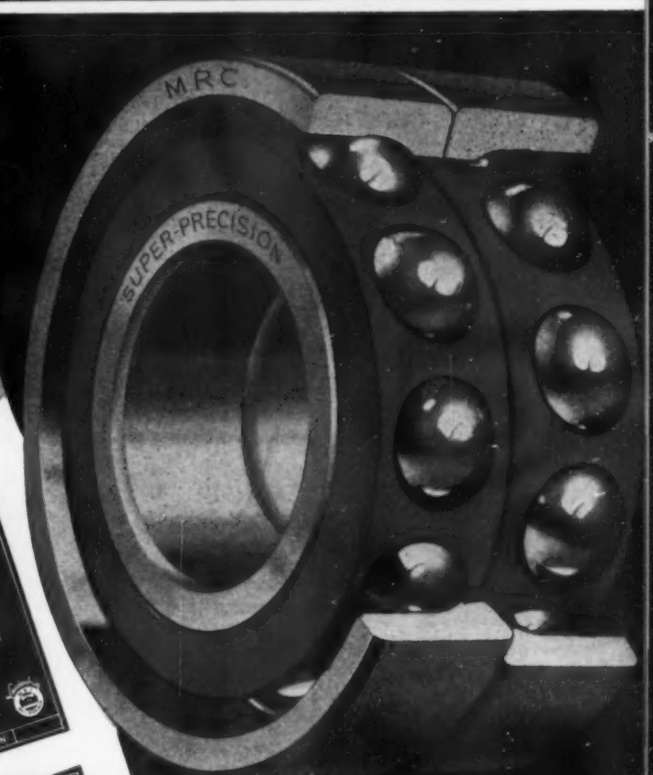












for

ACCURACY

RIGIDITY

HIGH SPEEDS

Leadership
M-R-C
STEEL
SRB
GURNEY
BALL BEARINGS

M-R-C BALL BEARINGS

MARLIN-ROCKWELL CORPORATION

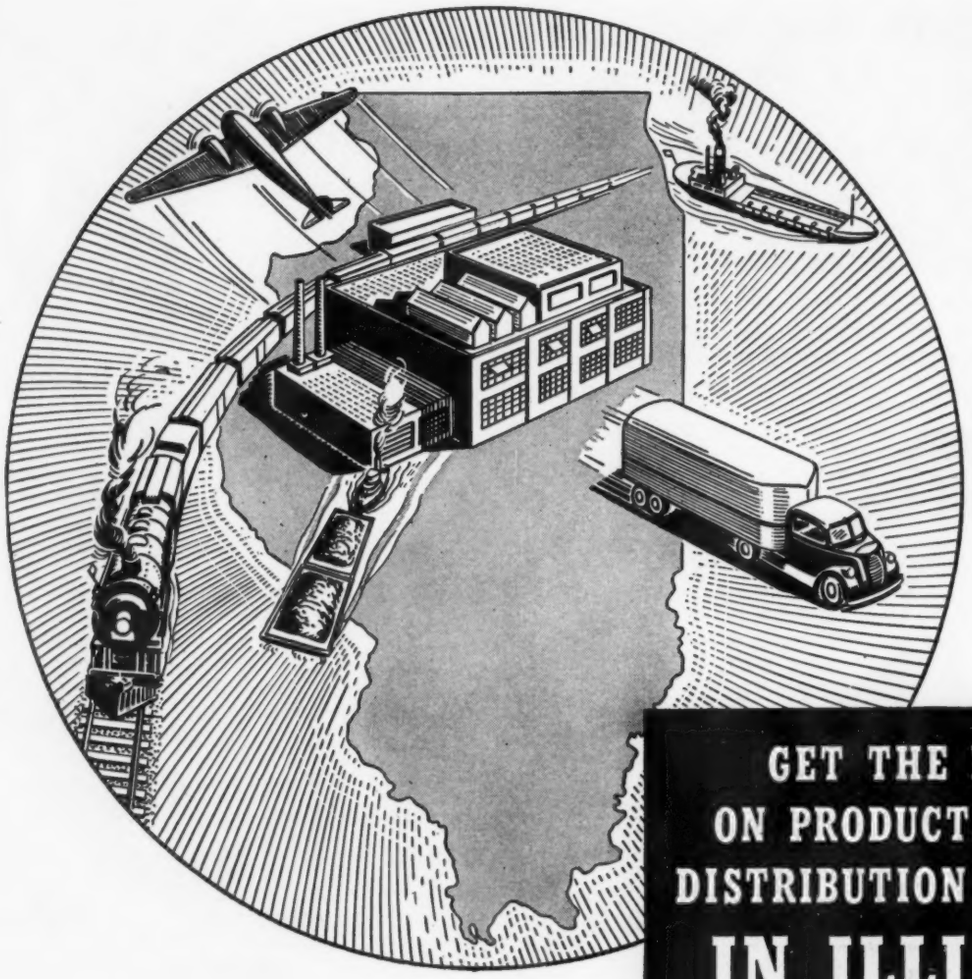
EXECUTIVE OFFICES: JAMESTOWN, N. Y. FACTORIES: JAMESTOWN, N. Y., PLAINVILLE, CONN.

PEAK at its Production

The newly developed Landis 16" Type IW Grinder for the simultaneous grinding of multiple diameters on crankshafts is setting new production records. ¶ An enthusiastic report from a large and internationally famous automobile manufacturing concern states that in the finish grinding of three main bearings, a profiled fan fit and the O. D. of the flange on each crankshaft, forty to forty-five an hour are produced in comparison to twelve per hour previously. Reduction in handling time is 80%. ¶ Manufacturers who cannot use such specialized equipment as this new IW Grinder will find that many other Landis grinders compare just as favorably in performance. No. 348

LANDIS TOOL COMPANY
WAYNESBORO • PENNSYLVANIA

HOW CAN YOU HUNT WITH A "BONE DOG"?
Gunning for profit in a behind-the-times plant is like hunting for rabbits with a "bone dog." Too much time and money is wasted on non-essentials, like buried bones, while the real sport of manufacturing goods at a profit skips out like a scared rabbit.
A hunt through your own plant may uncover plenty of "bone dogs" . . . snail-pace production and dividend-pile scrap losses.
But when you retool with modern LeBlond lathes and cutter grinders, with their faster-than-ever production speeds, and finer-than-ever precision operation, you bag a profit every time.
The R. K. LeBlond Machine Tool Co.
CINCINNATI, OHIO
LEBLOND
CINCINNATI, OHIO
U.S.A.



GET THE FACTS ON PRODUCTION AND DISTRIBUTION ECONOMY IN ILLINOIS

There is just one answer to the question of securing the most business from the huge Middle West Market. That is a plant or branch plant in Illinois, where the advantages offered to industry assure most profitable operations.

Production and distribution advantages are exceptional. Illinois produces or is the central receiving point for the raw materials essential to all types of manufacturing. The machinery requirements of industry are met by the many machine and tool manufacturers in Illinois, the second largest producing State of the Nation.

The transportation facilities of Illinois are unequalled. Illinois has the greatest railroad mileage of any industrial State, with direct service to all parts of the Nation. Illinois has the finest paved road system in the United States. Both rail and highway facilities serve all parts of Illinois, permitting a manufacturer to locate in whatever section of the State offers the most in accessibility to raw materials and labor supply. Both the Great Lakes-St. Lawrence Waterway, and the Lakes-to-the-Gulf Waterway serve Illinois, giving industries located in Illinois foreign trade advantages and access to the important Central and South American markets. Air services afford facilities for rapid transportation in emergencies, to all parts of the country.

Ample power supplies, abundant water, rich agricultural and mineral resources, low cost fuel, large labor supply, and the advantage of central location, are found in Illinois. Equitable labor laws contribute to industrial harmony. Illinois manufacturers pay NO State Income Tax, NO State Real Estate Tax, and NO State Machinery Tax.

Special Confidential Report to Executives

Get the facts on Illinois as they apply to your business. Write the Illinois Development Council at Springfield, Illinois, for data on raw materials, labor, taxes, power, fuel, transportation, and other facts pertaining to your business.

If you have some special problem in production or distribution, outline it in detail. If you desire a certain type of building, certain classification of workers, certain power requirements, or certain raw materials, state your needs and you will receive a special report on them. Your inquiry will, of course, be kept confidential. Write—

ILLINOIS DEVELOPMENT COUNCIL
STATE HOUSE • SPRINGFIELD, ILLINOIS

ILLINOIS

THE STATE OF BALANCED ADVANTAGES

THE UNION LINE IS *Complete*

And that means that you can fill every tool requirement from this single, convenient source of supply. But not only that—Union **completeness,** combined with Union **uniformity** and **high quality** make it easy to maintain a consistently high standard of quality and a profitable rate of production on every metal-removing job.

UNION TWIST DRILL CO., Athol, Mass.

S. W. CARD MFG. CO. DIV., MANSFIELD, MASS.
BUTTERFIELD DIV., DERBY LINE, VERMONT
BUTTERFIELD DIV., ROCK ISLAND, QUEBEC

DIVISIONS of the UNION TWIST DRILL COMPANY

UNION
BUTTERFIELD
S. W. CARD

"THRED-RITE" DIES

Fitted to every requirement of modern high-speed thread production, **"Thred-Rite"** Dies represent the adjustable collet die at its best. The features pointed out above are the result of exhaustive experiments in our specialized die department. Steels used in both die and holder have been carefully selected and heat-treated. Every finished die is tested for accuracy under conditions identical with those under which it is to work. Try "Thred-Rite" Dies on a tough production threading job, and let them prove their ability! Complete stock of all standard sizes in N.C. and N.F. series are available from any of the representatives listed below.

BUTTERFIELD DIVISION
DERBY LINE, VERMONT
ROCK ISLAND, QUEBEC

UNION
BUTTERFIELD
S. W. CARD

DIVISIONS of the UNION TWIST DRILL COMPANY

CARD TAPS

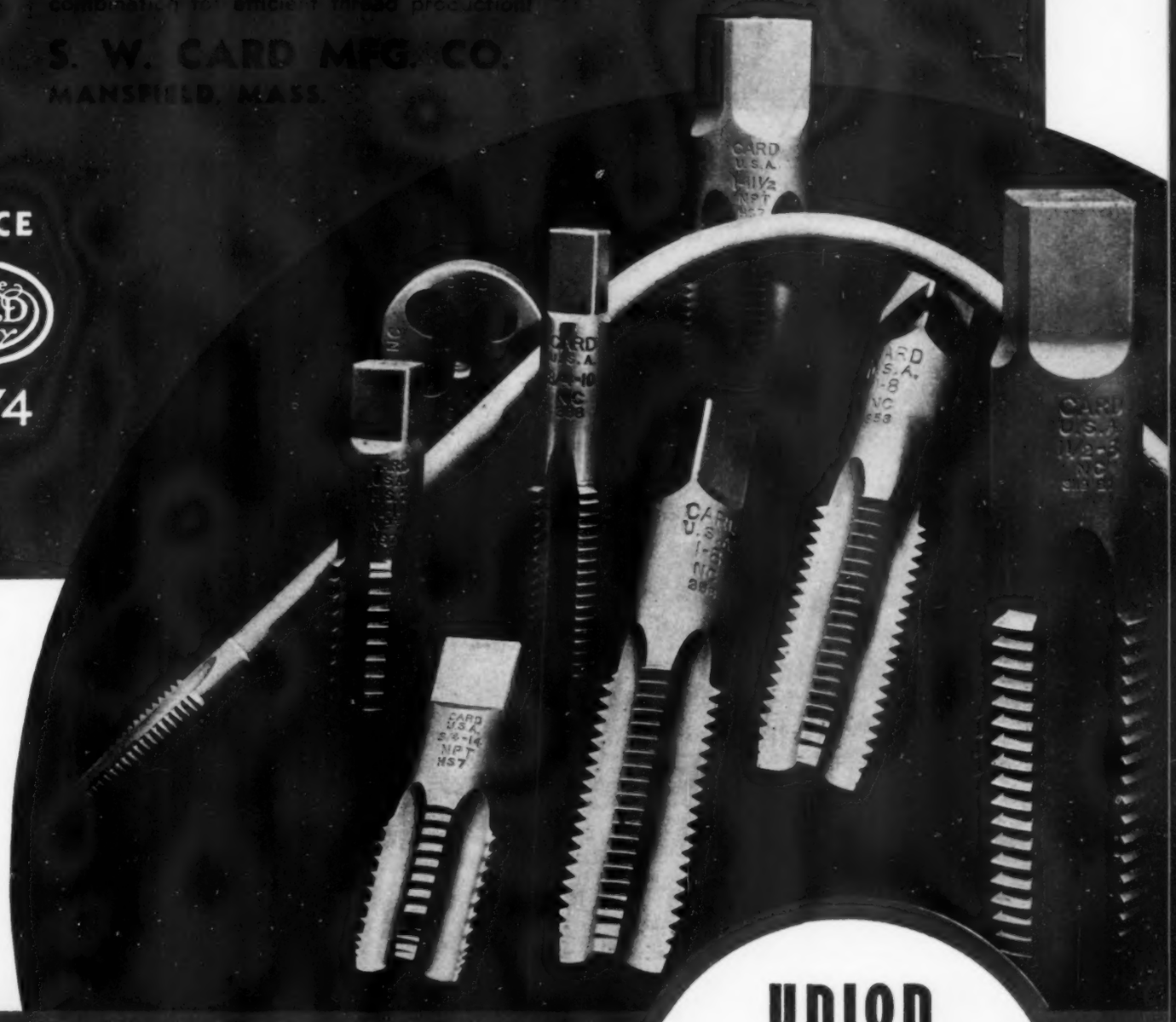
To get highest quality results from Card Quality Taps take advantage of Card Service.

We will analyze every phase of thread production, recommending the best procedure, the correct cutting speeds and, of course, the proper tap for every job.

Quality Taps plus Complete Service—an unbeatable combination for efficient thread production!

S. W. CARD MFG. CO.
MANSFIELD, MASS.

SINCE
C.A.R.D Quality
1874



DIVISIONS of the UNION TWIST DRILL COMPANY

UNION
BUTTERFIELD
S. W. CARD

Before we say "THIS STEEL HAS *Superior* MACHINING PROPERTIES" we prove it by tests like these

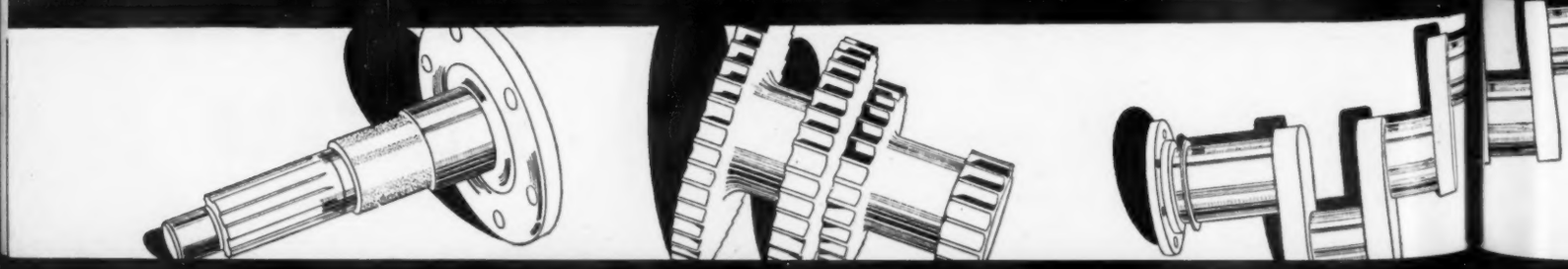
NOTHING IS LEFT TO CHANCE

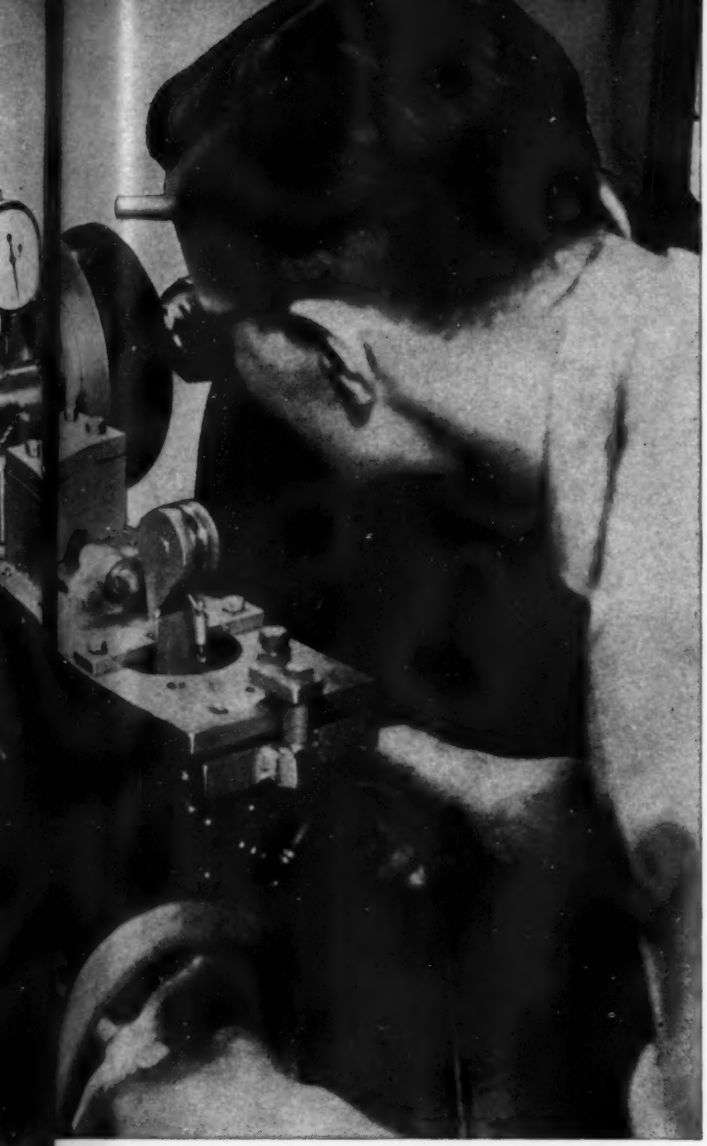
To give you the right steel that will do the best job for you—and to maintain its desirable characteristics in shipment after shipment, precise uniformity of control is exercised in every step, in every heat of U·S·S Carilloy Steel produced. It includes uniformity of selection of scrap for furnace charge, uniformity of furnace practice, uniformity of slag control, uniformity of tapping, pouring and rolling practice, and uniformly close metallurgical control, supervision and inspection throughout the above steps until the steel is delivered to your shop.

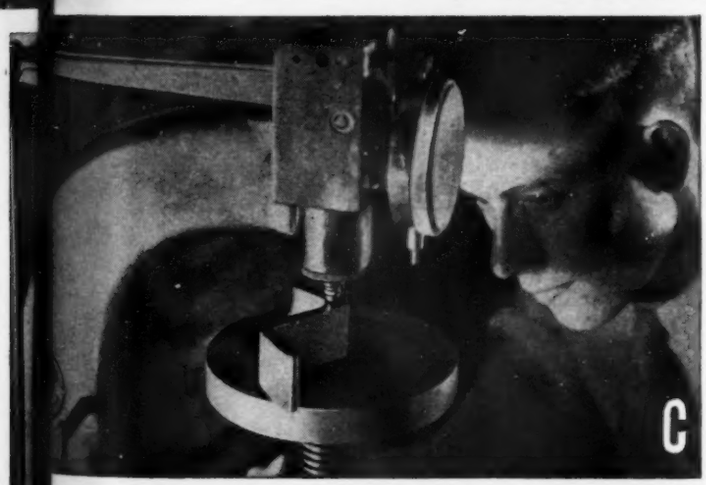
. . .

(A) This unusual lathe test is all important in studying machinability. (B) Metallographic microscope reveals facts about physical structure unobtainable in any other way. (C) Rockwell Test for hardness.

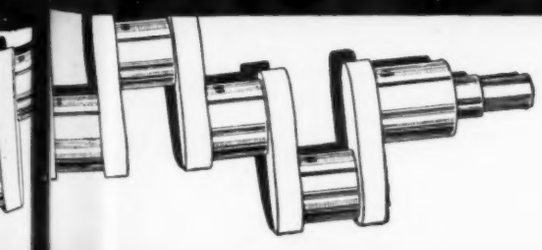
U·S·S CARILLOY *Dependable*







ALLOY STEELS



By digging out the facts that forecast performance, we make sure that U·S·S Carilloy Alloy Steels will function satisfactorily—in your plant and in your product.

YOU never saw a testing device quite like this. It is a development original with us—one of the busy tools in our metallurgical laboratory.

Here is a lathe fitted with ingenious control equipment, by which all operating variables during cutting are kept constant. This permits us to obtain a clear and accurate record of steel machinability.

By actually machining test bars on this equipment, we obtain invaluable comparative data on tool life and surface finish which indicate what production practices will give the user best results and the highest economy in fabrication for any particular application.

We emphasize this test because we believe it is unusual and because it illustrates how far we go beyond the routine physical and chemical check-ups to make sure that our alloy steels will exactly fill the bill for you.

With us, the making of U·S·S Carilloy Alloy Steels is a precise and exacting process. They are produced in a plant especially devoted to alloy steels. Here, the finest and most modern equipment is matched by the skill of experienced mill and metallurgical personnel. Every step in production from furnace to final inspection is on a controlled quality basis. Each order, whether large or small, gets individual care and attention.

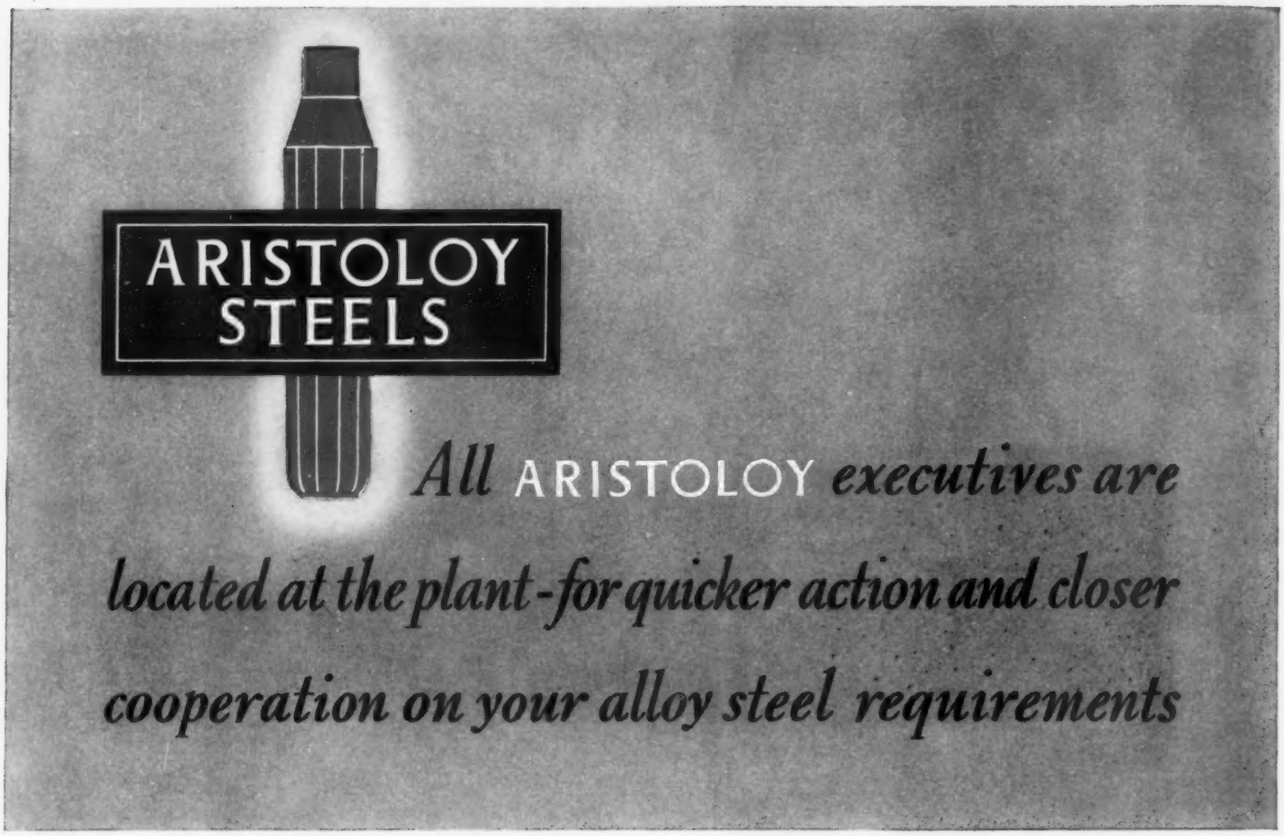
To be sure you get the *most* value from your steel dollar, ask our metallurgists to work out the economies of Carilloy Steels as they apply to your product.

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL



All ARISTOLOY *executives are located at the plant-for quicker action and closer cooperation on your alloy steel requirements*

WE TALK IT OVER ACROSS THE DESK . . . NOT ACROSS THE COUNTRY

All Aristoloy Executives and Department Heads have their working headquarters where Aristoloy Steels are made—at our Warren, Ohio plant. Talking it over across the desk, there's an easy, every-day interchange of information and experience. Centralized organization makes for closer cooperation, with less chance for error, delay, and misunderstanding. Aristoloy steel makers make steel *on the job* — not by remote control.

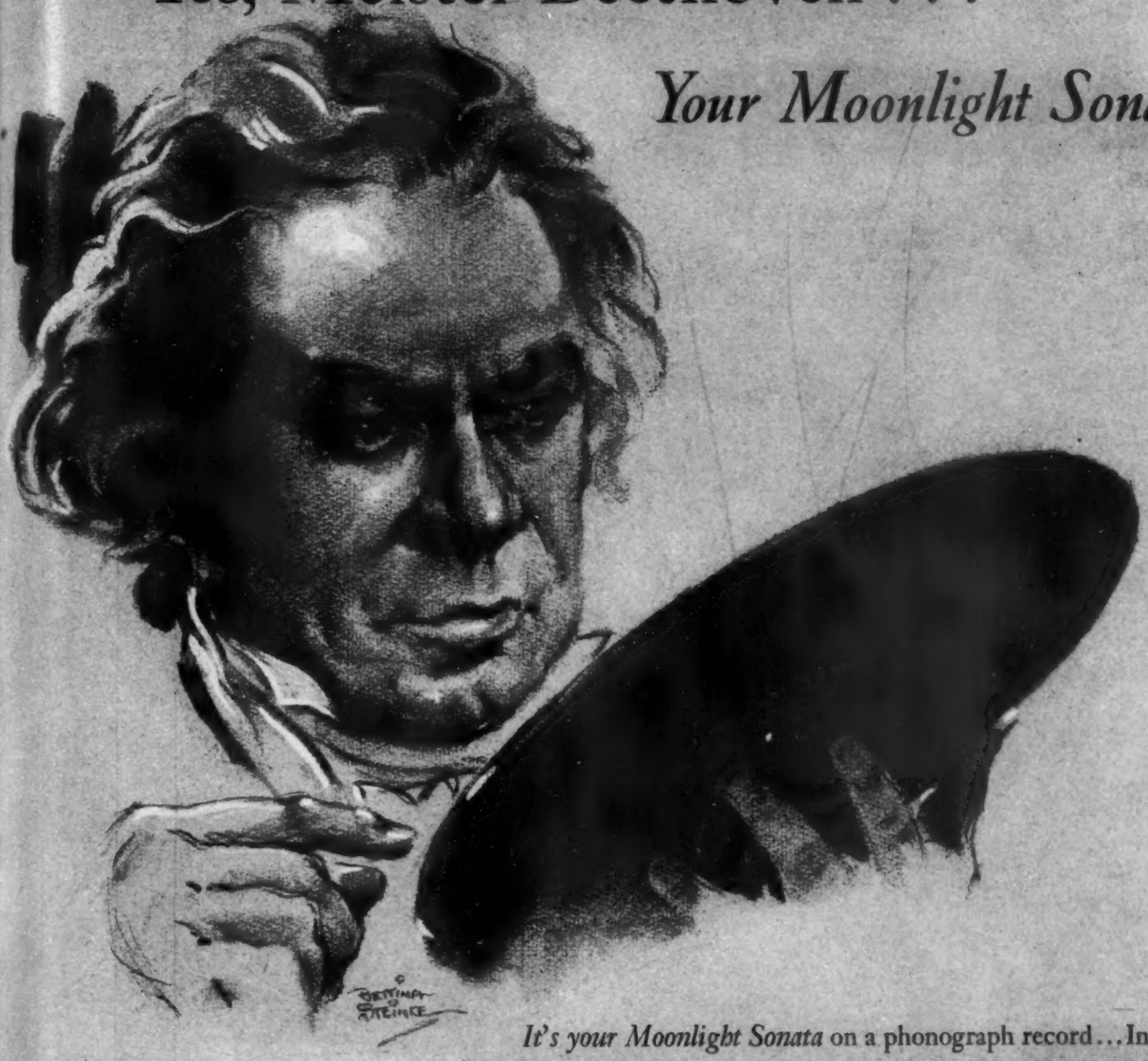
COPPERWELD STEEL COMPANY, WARREN, OHIO

Visit us at the
METAL SHOW
October 21-25, 1940
CLEVELAND, O.
Stop at our Aristoloy Exhibit—Booth F-20—and play "Aristoloy". You can't lose.
Prizes for high scores

ARISTOLOY S.A.E. ALLOY BILLETS AND BARS; AIRCRAFT QUALITY STEELS; OXIDATION AND CORROSION RESISTING STEELS; TOOL AND SPECIAL STEELS; STAINLESS STEELS

Yes, Meister Beethoven . . .

Your Moonlight Sonata



IN THE background of modern industry, you will find Pratt & Whitney machine tools, small tools and gages. Through accuracy, Pratt & Whitney keyword since 1860, production costs are lowered... new products are developed... new industries arise . . . new jobs are created. Pratt & Whitney accuracy makes rare luxuries common. Man moves to ever-improving comfort, economy, convenience, health, safety... across the background of Pratt & Whitney accuracy.

It's your Moonlight Sonata on a phonograph record... In these fine grooves are recorded the sound vibrations produced as the sonata was played. A needle connected with a sensitive diaphragm reproduces these sound waves.

Miraculous? Why, no . . . it's very simple. You see, it's done by machines that record the sound waves, produce the records in huge quantities, and with them reproduce the sounds in phonographs throughout the world.

No, they're not expensive. Production is standardized through the use of very accurate basic machines . . . jig borers, lathes, drills, millers, shapers, grinders, and so on. That is how we get "tenth of a thousandth of an inch accuracy."

Impossible to do these things by hand? You're right!

Accuracy

PRATT & WHITNEY

Division Niles-Bement-Pond Co. • West Hartford, Conn., U. S. A.

THIS is a picture of a rotor from a Fairbanks-Morse Motor

Notice the squirrel cage winding!

It is of copper. The *one* metal most desirable, electrically and mechanically, for meeting the severe service a modern motor must withstand. Copper, the *one* metal of low resistance and low thermal expansion—best able to withstand high temperatures caused by constant plugging and reversing service.

Note further that this copper is *centrifugally cast* into a one-piece winding. *Centrifugally cast* to imbed the winding into the core slots deeply and tightly.

Then, after casting, this rotor is machined and dynamically balanced to the famed Fairbanks-Morse standards of precision.

Only Fairbanks-Morse makes rotors with copper windings which are centrifugally cast. The Copperspun Rotor is an exclusive Fairbanks-Morse development, process, and feature.

For complete information on F-M Motors with Copperspun Rotors, write Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago, Ill. Branches and service stations throughout the United States and Canada.

7706-EA40.183

FAIRBANKS·MORSE, MOTORS

DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

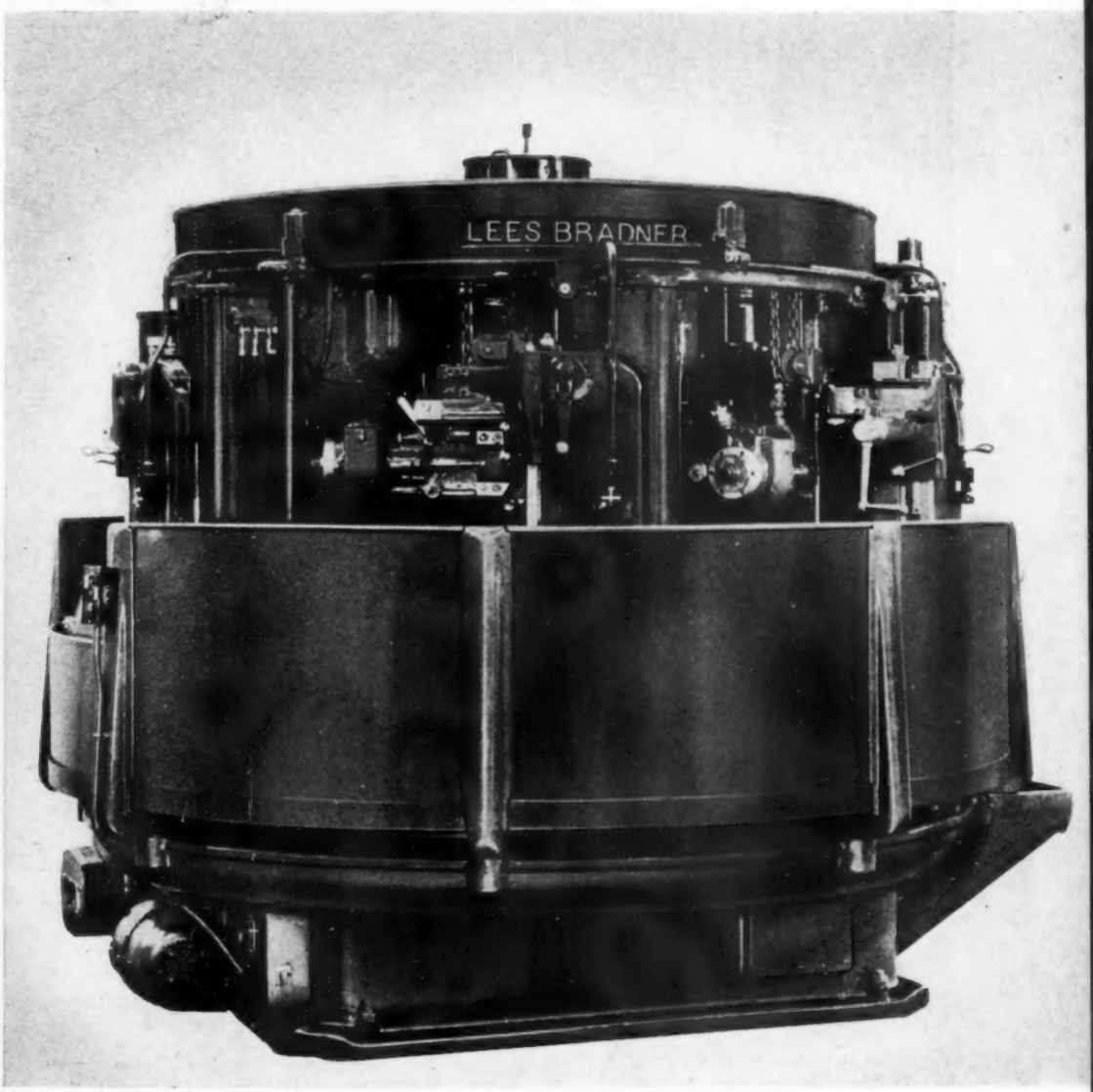
THE LEES-BRADNER

Lees-Bradner, pioneer of gear hobbing in this country, originated and developed the rotary hobbing process. Lees-Bradner Rotary Hobbing Machines today, built by the licensor of all manufacturers of this type of equipment, are unequaled for large scale gear production.

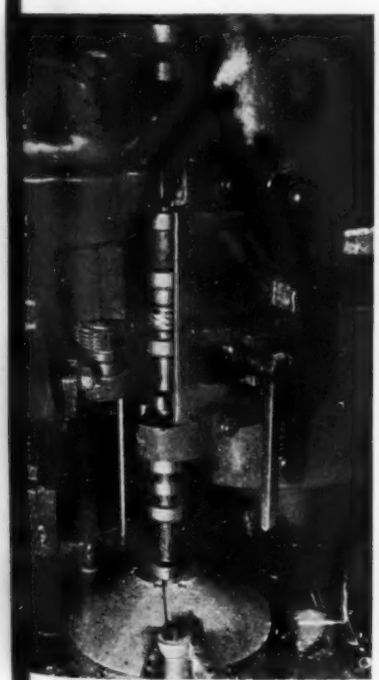
Lees-Bradner Rotary Machines with four, six or eight spindles are available and each of these spindles can be arranged for the same job, or for different jobs, climb or conventional cut.

If desired, the Lees-Bradner automatic Hob in-out mechanism can be supplied.

ROTARY GEAR HOBBING MACHINE

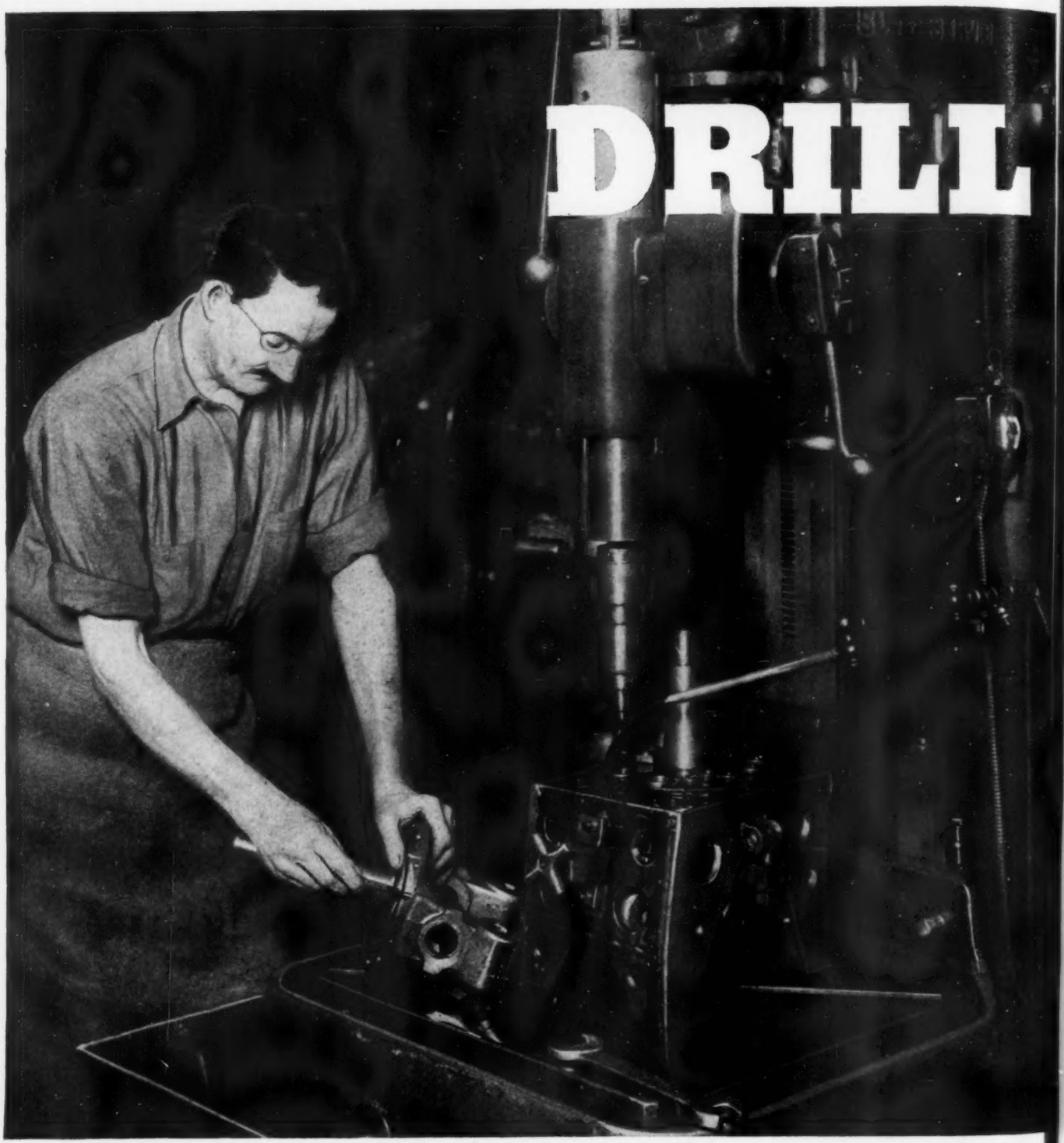


Close-up of gear in center of an automobile camshaft, hobbed on a Lees-Bradner Rotary Hobbing Machine arranged with automatic Hob in-out mechanism in the plant of a prominent automobile manufacturer. (Name on request).



Write us for our newly published Catalog, which illustrates and describes the full line of Lees-Bradner Machines. We also solicit specific inquiries. There is, of course, no obligation.

THE LEES-BRADNER CO., CLEVELAND, O.



TYPICAL SINGLE SPINDLE Cincinnati-Bickford Drill Press that showed a 200% increase in drill life, using *Texaco Sultex Cutting Oil B.*

TEXACO DEALERS invite you to enjoy Fred Allen in the new full-hour program of The Texaco Star Theatre... with Kenny Baker, Al Goodman's Orchestra and a great cast. Every Wednesday Night, Columbia Network. 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

TEXACO

REG. T. M.

TEXACO S

LIFE TRIPLED

THESE STEERING KNUCKLES machined on single spindle drill presses increased drill life from 4 to 12 pieces . . . *when Texaco Sultex Cutting Oil B* was used.

THESE FORGINGS of SAE 4130 steel, Brinell hardness 241, are drilled in single spindle Cincinnati-Bickford Drill Presses.

Not only are feed and spindle speeds increased, but the life of the drills shows an increase of 200%.

The only change made to get these money-saving results was to use *TEXACO SULTEX CUTTING OIL B.*

Texaco Sultex Cutting Oils possess the vital property of constantly penetrating to the very edge of the tool, preventing the chip from welding to it. These oils keep cutters cool, free-cutting, sharp, longer-lived. Our cutting oil engineers will gladly cooperate in making savings with *Texaco Sultex Cutting* and *Soluble Oils* in *your* shop. Phone the nearest of more than 2300 Texaco warehousing points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., N.Y., N.Y.

SULTEX CUTTING AND SOLUBLE OILS

LATROBE

HIGH SPEED STEELS
for every need

ELECTRITE NO. 1
ELECTRITE NO. 19
ELECTRITE VANADIUM
ELECTRITE TATMO
ELECTRITE COBALT
ELECTRITE SUPER COBALT
ELECTRITE ULTRA COBALT

Stocked in Principal Cities

Users of high speed steels who are contributing their part to the national defense program will find ELECTRITE NO. 1 fittingly adapted to this new tempo of production.

This 18-4-1 High Speed Steel possesses a maximum of red hardness and wear-resistance ideal for quality cutting tools. It responds readily to heat treatment, has a highly uniform grain structure and is of maximum density . . . factors which result in *uniformly sound, tough* steel!

Ask for latest bulletin on Latrobe Electrite No. 1 high-speed steel.

LESCO

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT •• LATROBE • PENNSYLVANIA

Today You Need SPEED

IN YOUR SHOP EQUIPMENT

NOW, more than ever, you need shop machinery that will produce more in less time. High spindle speeds are essential for the efficient use of modern sintered carbide and diamond cutting tools. Smooth, vibration-free operation at high speed is achieved in South Bend Lathes by using a direct belt drive to the spindle, a precision balanced spindle assembly and spindle bearing surfaces that are hardened, ground and superfinished to a smoothness of five micro-inches (.000005").

At right—10" Swing, 1" Collet Capacity South Bend Tool Room Precision Bench Lathe. This lathe has nine spindle speeds ranging from 50 to 1357 R.P.M., 1⅜" hole through spindle, 1" maximum collet capacity, 48 power longitudinal carriage feeds, 48 power cross feeds, and cuts 48 different pitches of screw threads.

SIZES OF SOUTH BEND LATHES

Swing	Bed Lengths	Center Distances
9"	3' to 4½'	16" to 34"
10"	3' to 4½'	15¾" to 33¾"
13"	4' to 7'	16" to 52"
14½"	5' to 10'	24½" to 84½"
16"	6' to 12'	33½" to 105½"

PARTIAL LIST OF DEALERS

See a South Bend Lathe before you buy. Write today for free catalog and name of nearest dealer.

Baltimore, Md.—Carey Mach. & Supply
Boston, Mass.—South Bend Lathe Works*
Bridgeport, Conn.—A. C. Bisgood
Buffalo, N.Y.—R. C. Neal Company, Inc.
Chicago, Ill.—South Bend Lathe Works†
Cleveland, Ohio—Reynolds Mach. Co.
Dayton Ohio—C. H. Gosiger Mach. Co.
Detroit, Mich.—Lee Machinery Company
Los Angeles, Cal.—Eccles & Davies Mach.
Milwaukee, Wis.—W. A. Voell Mach. Co.
Newark, N. J.—J. R. Edwards Mach. Co.
New York, N.Y.—A. C. Colby Mach. Co.
Philadelphia, Pa.—W. B. Rapp, Mach.
Pittsburgh, Pa.—Tranter Mfg. Company
Portland, Ore.—Portland Machinery Co.
Providence, R.I.—Geo. T. Reynolds & Son
Rochester, N. Y.—Ogden R. Adams
St. Paul, Minn.—Robinson, Cary & Sands
San Francisco, Cal.—Moore Mach. Co.
Seattle, Wash.—Star Machinery Company
Syracuse, N. Y.—H. A. Smith, Machinery
York, Pa.—York Machinery & Supply Co.

*Boston Sales Office: 67 B'dway, Kendall Sq., Cambridge, Mass., Tel. Trowbridge 6369
†Chicago Sales Office: Room 308, Machinery Sales Building, Telephone State 7283

TRADE MARK SOUTH BEND TWINS ENGINE LATHES

WE FAVOR ADEQUATE PREPAREDNESS FOR NATIONAL DEFENSE

SOUTH BEND LATHE WORKS *Lathe Builders Since 1906*

954 E. Madison Street, South Bend, Indiana, U. S. A.

» » » HAMILTON STANDARD DIVISION OF UNITED AIRCRAFT HAS THE LARGEST CLEVELAND *Single Spindle* AUTOMATIC EVER BUILT « «

● For nearly 15 years they have made certain parts of airplane propellers on Cleveland Automatics, and today, the Hamilton Standard Propellers Division of United Aircraft Corporation at East Hartford, Connecticut continues to make various precision parts of the variable pitch propellers which they pioneered on Cleveland machines. In fact, just recently, they installed the largest Cleveland *Single Spindle* Automatic, Model A, ever built—a machine of 9-inch capacity. It supplements a large battery of Model A machines in their production.

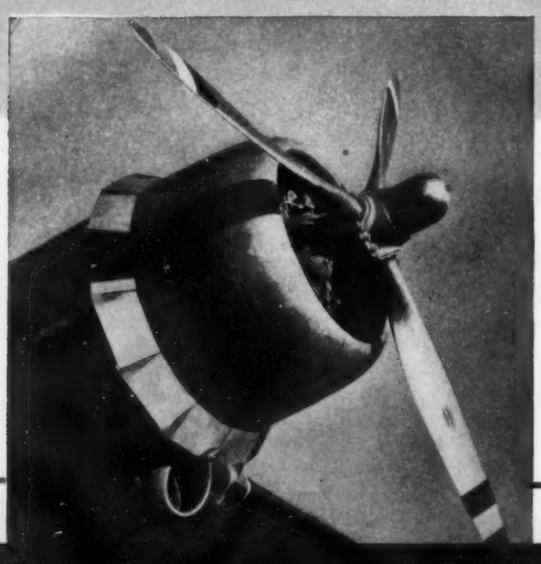
Hamilton Standard propellers are used on every domestic airline, on the majority of the world's airlines, as well as on military aircraft. They emerge from production a complete, highly specialized machine in themselves, ranging from 7 feet to 18 feet in diameter. Every blade is checked for balance before going to assembly, and barrels and domes are also balanced as individual units prior to assembly. When assembled with all their parts, the complete propellers receive a final balance. In the manufacture of these propellers, each component part is held to close tolerances to provide interchangeability. Every step in their manufacture is a precision operation, for the lives of pilots and passengers depend upon this quality production standard being maintained even at today's mass production volume.

Stop rings, piston gasket nuts, and cam bearing retaining nuts are produced from SAE 6135 Tube stock on this new Cleveland Model A.

●

Investigate the possibilities of Cleveland *Single Spindle* Automatics in your production. Ask for brochure on the new Model AA, latest and finest of the Cleveland line. Built in 1 1/16" and 1 3/8" capacities, it's making history in many plants today on short run, small lot production.

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 ASHLAND ROAD • CLEVELAND, OHIO
Sales Offices: NEW YORK—50 Church Street • DETROIT—2842 Grand Boulevard
CHICAGO—565 West Washington Street • CINCINNATI—314 American Building



Operations in producing the Dome Retaining Nuts being made on this 9-inch Cleveland Model A, shown at right, consist of feeding out, turning, boring, forming and parting—(four pieces cut off simultaneously). Costs are reduced 66% and production increased 200% over previous methods for producing this same part.

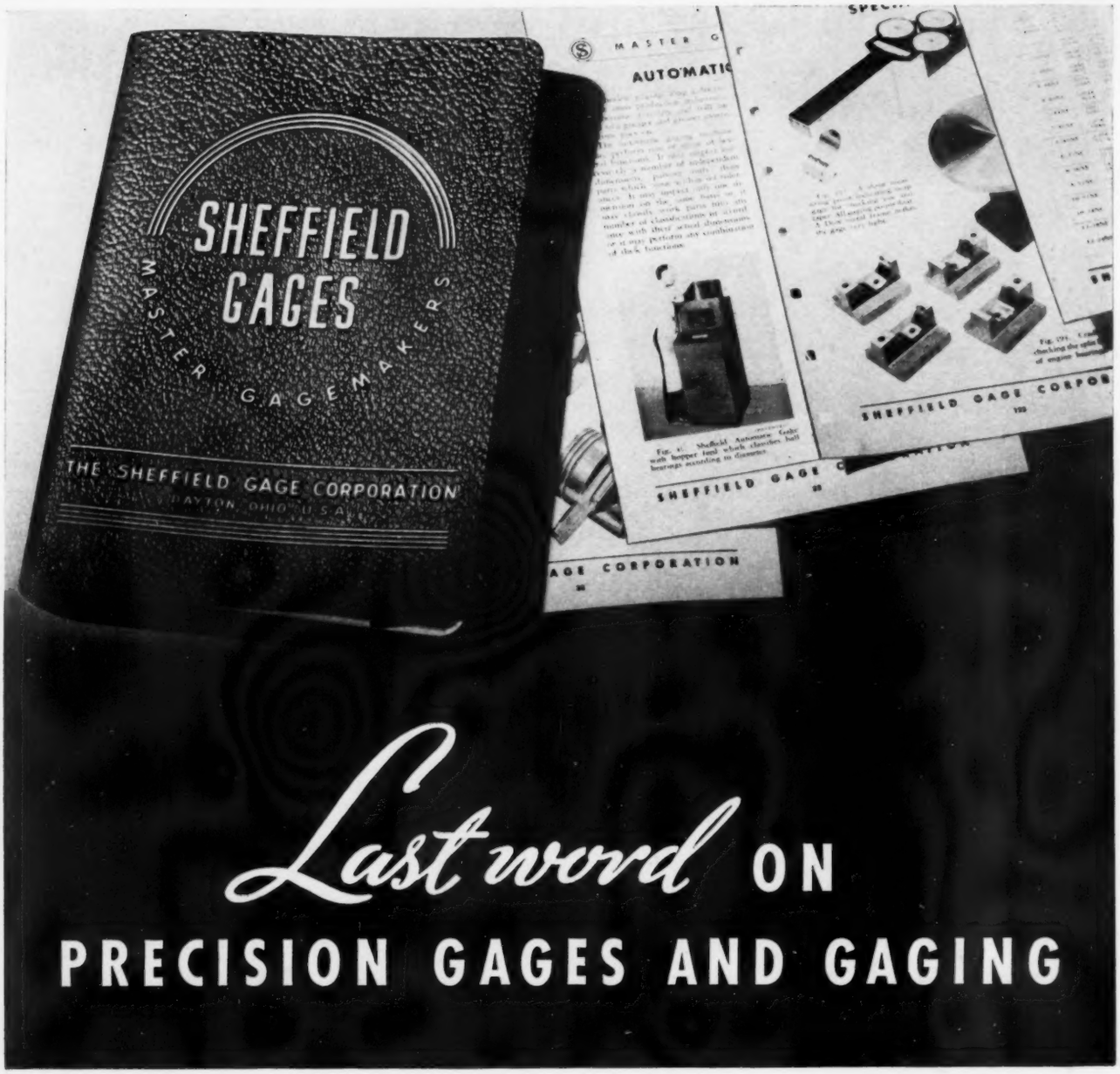
Photographed through courtesy of Hamilton Standard Propellers Division of UNITED AIRCRAFT CORPORATION, East Hartford, Conn.

CLEVELAND

MODEL AA *Single Spindle* AUTOMATIC

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL AA—Built in 1 1/16-inch and 1 3/8-inch capacities only



Last word ON PRECISION GAGES AND GAGING

"SHEFFIELD GAGES" just off the press is a comprehensive presentation of precision gages — design, construction and application together with standards and constants useful in practical inspection work.

Manufacturers engaged in the manufacture of engines, machine tools, automotive or military equipment, or any enterprise where inter-changeability of parts is essential, will find this book very useful.

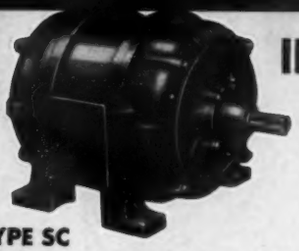
Write for your copy on your own letterhead—no obligation.

THE SHEFFIELD GAGE CORPORATION

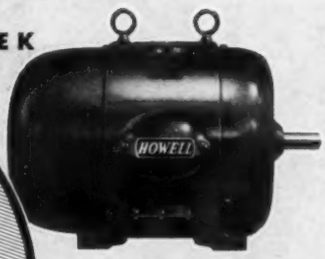
1520 EAST THIRD STREET

DAYTON, OHIO, U. S. A.

HOWELL MOTORS—
Safeguard Machine Tool Performance



TYPE SC



TYPE K

INDUSTRIAL TYPE MOTORS
. . . A COMPLETE LINE

For 25 years HOWELL has specialized on polyphase motors for industrial drives. We build these motors with any electrical and mechanical characteristics required, in sizes ½ to 150 HP.

STANDARD OPEN TYPE MOTORS, **Type SC, are recommended for normal service conditions — furnished with either sleeve or ball bearings.**

TOTALLY-ENCLOSED, FAN-COOLED MOTORS, **Type K with ball bearings, are widely used where dusts, fumes or moisture make ordinary open motors short lived. Totally-enclosed feature protects all working parts. Fan cooling prevents overheating in the most strenuous service.**

EXAMPLES OF PRECISION

One in a Series of Advertisements, "HOWELL Motors in the Making" — showing how modern precision standards maintain HOWELL quality.

STATORS AND ROTORS ARE GROUND
. . Insuring Uniform Air Gap

Photograph above illustrates how stator bores are ground at HOWELL — a precision operation kept within tolerances of .001 inches. Rotors are also given a ground finish of the same exacting nature.

Precision manufacture of both stators and rotors guarantees that every HOWELL Motor has a uniform air gap. This uniform air gap reduces vibration and noise, increases operating efficiency, and assures long bearing life.

The close tolerances maintained throughout in the building of HOWELL Motors enable you to get MORE ACCURATE machine tool production.

Fast Delivery!

Your motor requirements—are they standard or special? Whatever your needs, the HOWELL organization is sufficiently flexible to meet them EXACTLY, and on time. Write us today, outlining your particular drive problem!

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN • • • *Representatives in All Principal Cities*

TO HELP YOU PRODUCE STAINLESS PARTS FOR LESS MONEY

SUPPOSE you could blank and form stainless with an assurance of fewer shop hold-ups and reduced unit costs. Wouldn't this mean that more of your products could be given the extra sales appeal of stainless steel—or the additional lightness and strength? Wouldn't this help you in putting over your pet ideas? If so, here are facts:

THE PLACE TO LOOK FOR LOWER STAINLESS COSTS IS BEHIND THE CURTAIN OF PRODUCTION DELAYS.

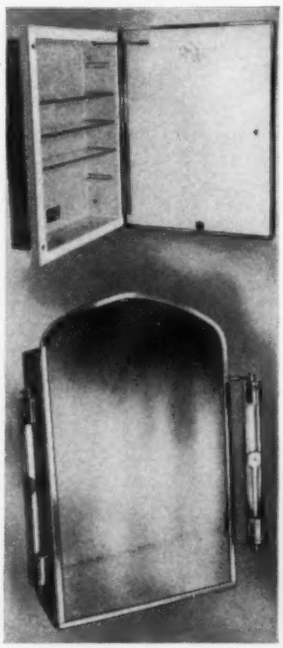
When presses are stopped because of trouble with the stainless strip, output suffers and costs rise. Yet the common interruptions—those caused by excessive burrs, ragged edges, tears, wrinkles, scratches, premature die wear, etc.—can be materially reduced or almost entirely avoided. With two precautions, it is usually possible to turn out stainless parts at speeds comparable with mild steel production rates.

The first precaution is to remember that stainless averages 50% stronger than mild steel. In fact, the higher physical properties of stainless may be the very reason why you are using it. On the other hand, these higher physical properties do call for more attention to proper tooling and lubrication, and they may call for the use of one size heavier press, or stock of a slightly lighter gauge.

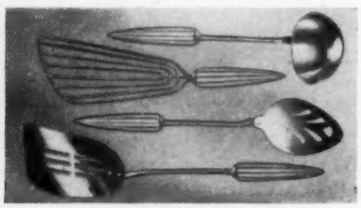
The second precaution is to pick the right stainless for the job. That's where Carpenter comes in with stainless strip analyses specially developed for easy-working qualities. Each grade is a soft, clean blanking strip, uniform in gauge, temper, color and finish. Each is an electric furnace steel made under the close control customary in a tool steel mill. We believe it is our job, too, to help you select from these steels the one that best meets shop *and* service requirements.

As both a tool steel and stainless steel mill, Carpenter is unusually well prepared to aid you in meeting both the above precautions. Carpenter representatives can offer dozens of useful hints on tooling up and can work with your men on smoothing out trouble with stainless stock. They can put in your hands a great deal of helpful literature on both subjects. That is an important dual service worth using.

You can start to cash in now on these service facilities. We have prepared a very useful, quick reference Stainless Steel Slide Chart which we will be glad to send you without obligation. Pocket size, it gives you a quick summary of technical data on Carpenter and other stainless steels. If you do not already have this chart, send for your free copy today.



"NO PLATING TO PEEL—EASIER FABRICATION"
These two bathroom cabinets were installed in a New York City housing project. Because they are trimmed with Carpenter Stainless No. 6, they will have a permanent good appearance—and yet fabricating costs are well within limits.



"SOFT ENOUGH FOR LADLES—SPRINGY ENOUGH FOR SPATULAS."
These attractive utensils are formed from Carpenter Stainless No. 6 at a cost low enough to sell in a highly competitive market—thanks to the clean blanking, fast forming characteristics of this steel. Carpenter Stainless Strip can be purchased in a variety of tempers—dead soft for drawing a ladle, or spring tempered for a spatula.

THE CARPENTER STEEL COMPANY...READING, PA.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

"BECAUSE IT DRAWS BETTER THAN ANY 18-8 PREVIOUSLY TRIED"
That was the reason for using Carpenter Stainless No. 4, says the manufacturer of these soap dispenser parts. Notice that some of these parts are drawn as deep or deeper than the diameter.
FREE
TO STAINLESS USERS IN U.S.A.
more than corrosion resistance

THE CARPENTER STEEL COMPANY
117 BERN STREET, READING, PA.

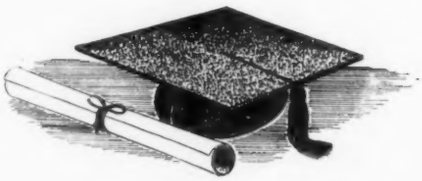
Gentlemen: Without obligation, please send me your free Stainless Steel Selector Slide Chart.

NAME _____ TITLE _____
Please Print

FIRM _____
(Firm Name Must Be Given)

ADDRESS _____

CITY _____ STATE _____



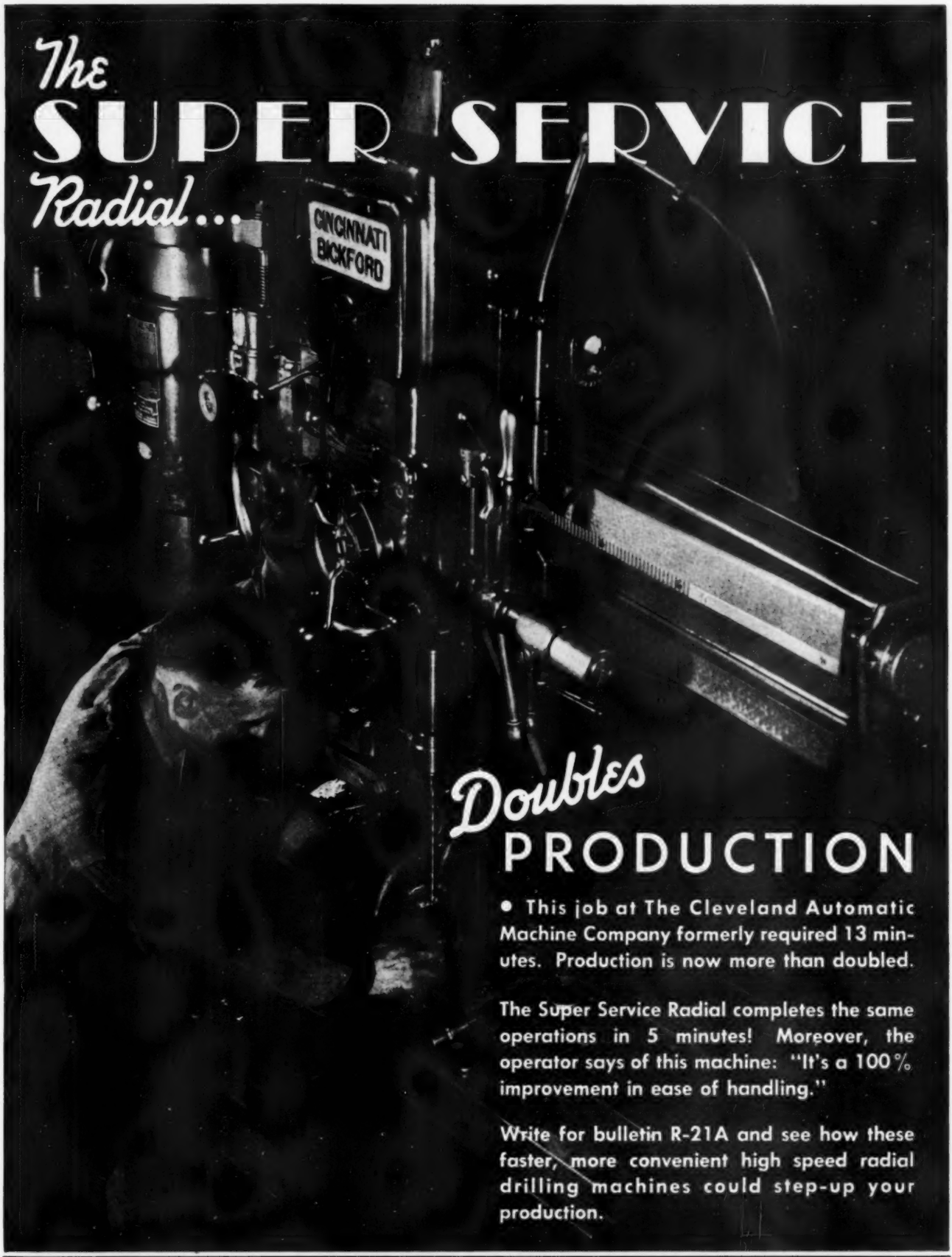
Young Men of an Old School...

THE TAFT-PEIRCE APPRENTICE SCHOOL critically selects young men of exceptional aptitude, and thoroughly trains them in the inflexible Taft-Peirce tradition of old-fashioned pride in precision of work.

In this way, competent new recruits are continually added to the ranks of one of the world's most expert and widely experienced corps of master machinists. To anything made of metal, these men apply the highest grade of skill, on modern machines that make possible the highest rate of production. For *you*, they can produce anything from a simple gage to a complex mechanism . . . in part or entirety . . . singly or in quantity . . . . according to your own blueprints and specifications. You will be interested to learn the full scope and reasonable cost of Taft-Peirce Contract Manufacturing Service. Write on your letterhead to THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

TAKE IT TO TAFT-PEIRCE

The SUPER SERVICE Radial...



Doubles PRODUCTION

• This job at The Cleveland Automatic Machine Company formerly required 13 minutes. Production is now more than doubled.

The Super Service Radial completes the same operations in 5 minutes! Moreover, the operator says of this machine: "It's a 100% improvement in ease of handling."

Write for bulletin R-21A and see how these faster, more convenient high speed radial drilling machines could step-up your production.

RADIAL AND UPRIGHT DRILLING MACHINES

The CINCINNATI BICKFORD Tool Co.

OAKLEY • CINCINNATI • OHIO • UNITED STATES OF AMERICA

50,000,000 Frenchmen can be wrong
...AND WERE!

They thought they could eat their cake and have it, too—thought they could be safe from invasion and yet take life easy. Workmen wanted short hours, business wanted easy taxes, youth wanted play.

Then the Germans came—came in the planes and tanks, with the guns and bombs that Frenchmen hadn't worked hard enough to produce. And now Frenchmen seem headed for serfdom—toiling long hours at starvation wages—because they forgot that the price of liberty is *hard work.*

America *must not* make that same tragic mistake. And it will not, if American industry and labor can prevent it—as they can.

At Warner & Swasey, for example, our men are working in three shifts 24 hours a day to supply the government and industry with the turret lathes without which America cannot rearm. Many of our workmen have sons who would be called in selective service. The more turret lathes these fathers turn out, the more airplanes, tanks and guns the government can make—to better arm and protect their sons and their country if need comes.

For most of our 60 years our workmen and Warner & Swasey have grown up together making turret lathes which turn out the products of peace—parts for baby carriages, radios, washing machines, automobiles. We asked nothing more of life than the chance to continue such work.

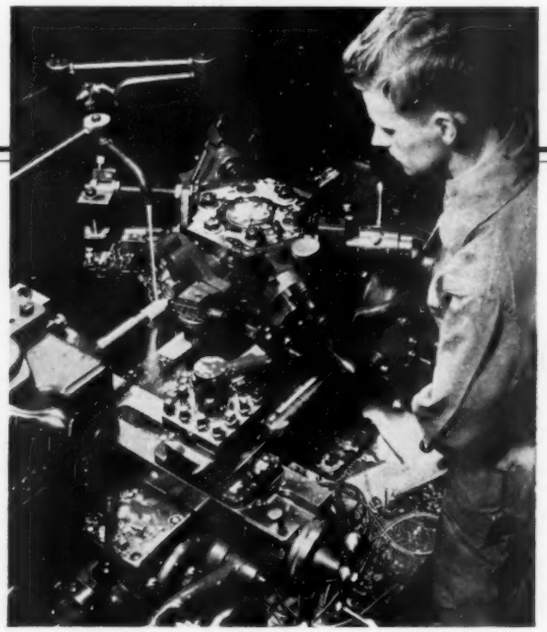
But suddenly our country is in a dangerous emergency. You can't make the engines of defense without turret lathes.

The government demands them from industry—and industry says it can deliver only if we supply turret lathes.

Our normal production is ample for all peace-time needs. Yet we would be failing our country if we sat back and conserved our resources now. Therefore, Warner & Swasey has built two additions to its plant, to supply the government with the turret lathes needed to make America secure.

This is an emergency, and we are proud to submerge ourselves for the safety of the nation to which we belong.

WARNER & SWASEY
Turret Lathes
Cleveland



YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . . WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

American Society for Metals

JAMES P. GILL

OSCAR E. HARDER

American Welding Society

GEORGE T. HORTON

COL. G. F. JENKS

CAN YOU AFFORD . . ?

The other night we were waylaid by an enterprising automobile salesman. He had mistakenly assumed we were planning to part with our old jalopy and some $750 for a longer, wider, roomier, heavier, shinier, snappier new car. (Name on request). After appealing to every buying urge from personal pride to passionate patriotism, he finally got around to the classic argument, "you can't afford *not* to buy a new car!" Being a mere engineer, and not a salesman, we were stopped by that one, so we retired to our hideout to wrestle with the dollars and cents.

The net result was that we still couldn't figure why it would be cheaper to haul around 3600 pounds instead of 2700, or how we could save money feeding eight cylinders instead of six.

This all leads up to the fact that we are as acutely aware as anyone that the old sales gag, "You can't afford *not* to . . . " is often just so much hot air. But we sincerely feel, engineering background and all, that there isn't any catch when we say you can't afford not to visit the Metal Show.

But we realize only too well, what with the press of expansion and defense work, lots of folks won't be able to take in the show this year. So we've prepared a preview of all the *new* equipment to be displayed in Cleveland. You'll find it described and illustrated in the special "Show-in-Print" section which begins on page 794.

WHO'S WHO

If you're going to the show the list on page 807 should prove a big help. It tells who is exhibiting, what will be on display, and which booth number is which.

HEAT-TREATING FOR PEACE

Despite the fact that this issue is devoted entirely to the Metal Show, the usual AMERICAN MACHINIST Armament Section is not omitted. This one starts off with a pictorial presentation of the part that heat-treating plays in national defense. Those already working on defense items know that that part is no trivial one; others may be a little surprised at the vital role it does play in the production of many items. For some samples, turn to page 810.

UNITED WE STAND

You don't need to be a fifth-columnist baiter to appreciate the wisdom of the old motto, "United we stand, divided we fall." It could be applied with almost equal force to all types of construction—including machine fabrication. For the history of metal-working progress is in a large measure the history of metal-uniting techniques. Of these none has been more spectacular than the advances made in the art of welding. In defense items as well as in other innumerable lines welding serves an important need. Examples of its contribution to U.S. security begin on page 818.

STEELING THE SHOW

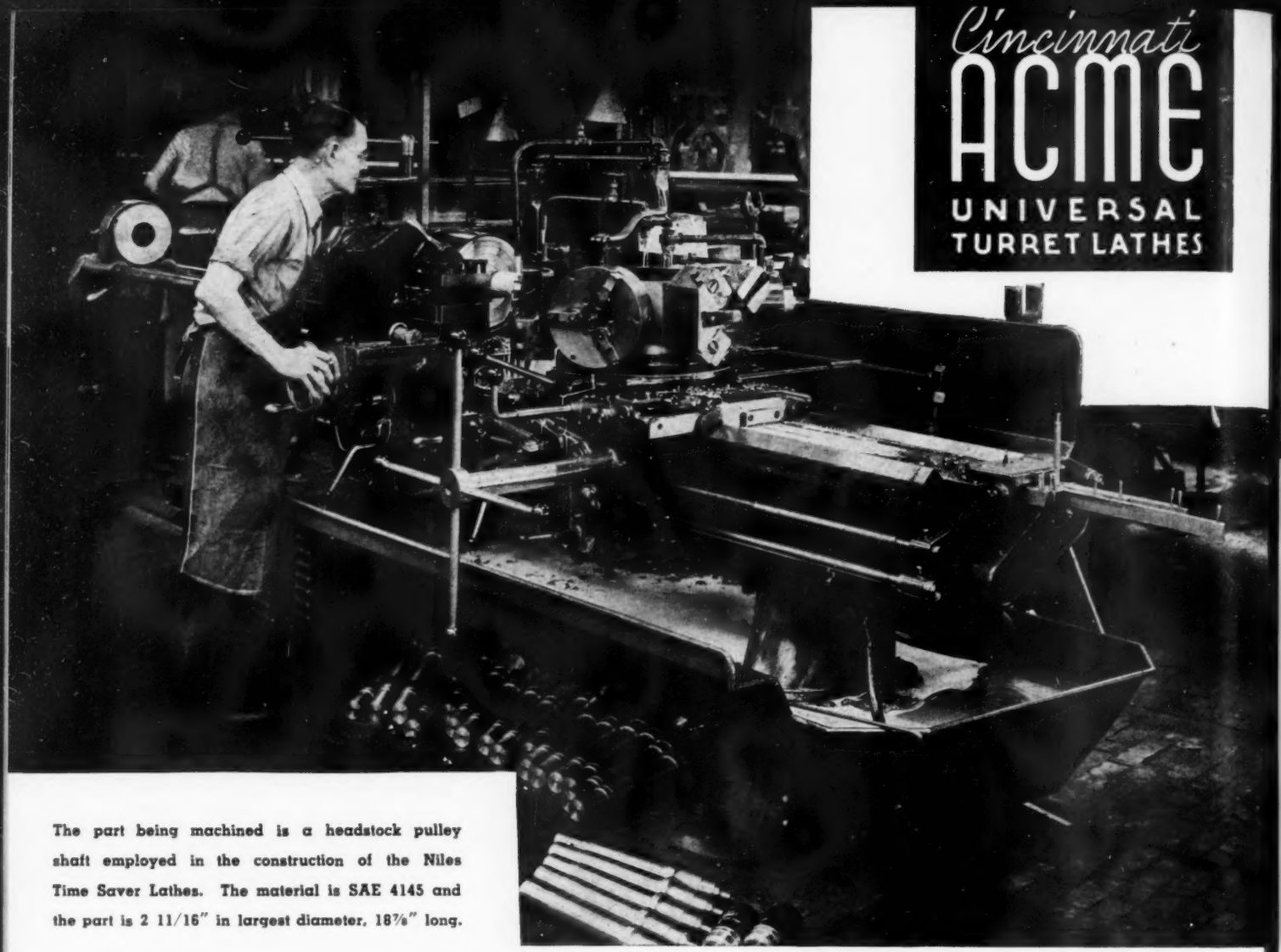
No, not a typographical error, but only to lead the conversation around to the special section on the working of carbon sheet steel. Since you're already familiar with these materials sections, the only thing we can tell you about is that it begins on page 825—yes, the blue paper.

PRESENTING THE PRESIDENTS

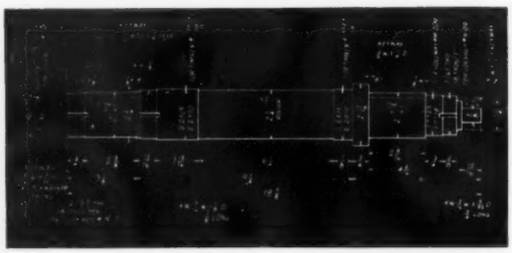
The National Metal Congress & Exposition, as it's officially called, is largely the result of efforts of the leading metal societies, staged every year by William H. Eisenman, secretary of the A.S.M. Cooperating closely with Mr. Eisenman are the society heads, several of whom we present herewith. James P. Gill, of Vanadium Alloys Steel Corp., has served for the past year as president of the American Society for Metals, while George T. Horton has held the same office in the American Welding Society. They will be succeeded by Oscar E. Harder, Battelle Memorial Institute, and Col. G. F. Jenks, Ordnance Department, U. S. Army.

COMING

Next number the Armament Section will again be with us to maintain the pace. Also scheduled are the last half of the infra-red baking article, the first part of a series on truing grinding wheels, a story on welded-riveted hopper cars, and others.



The part being machined is a headstock pulley shaft employed in the construction of the Niles Time Saver Lathes. The material is SAE 4145 and the part is 2 11/16" in largest diameter, 18⅞" long.



22% SAVED IN TIME . . .

FOR THE NILES TOOL WORKS

This CINCINNATI ACME Universal Turret Lathe—one of two recently installed in the plant of Niles Tool Works, Division of General Machinery Corporation, Hamilton, Ohio—is speeding up the production of Niles Time Saver Lathes.

To quote from a report recently received from this plant: "We have checked the savings in time on the new machine (a No. 2, 3½" bar capacity Cincinnati Acme) and find the savings amount to approximately 22%."

Many other machine tool builders and manufacturers have chosen Cincinnati Acme Universal Turret Lathes to handle high production and maintain accuracy under closely held tolerances. Operating convenience, versatility and ability to take advantage of fast cutting carbide and similar tools are a few of the many reasons why Cincinnati Acmes play an important part in modernization programs.

Consult our engineers on any problem involving turret lathe production.

...The ACME MACHINE TOOL CO., ...CINCINNATI, OHIO.

ESTABLISHED 1877 AMERICAN MACHINIST BURNHAM FINNEY, Editor

Metal Show

Metals for Defense

REAMS have been written about the difficult job of tooling up for manufacture of munitions. Somehow the part played by the machinist is magnified until it dominates everything. While admittedly his activities are of primary importance, attention should be given the welder, the heat-treater and the metal finisher too.

That is why the National Metal Show comes at an opportune time. The armament production program cannot succeed unless all operating elements are under complete control and are functioning effectively. The more widely used the latest technique in welding, heat-treating and finishing (as well as machining), the more successful the program and the higher the output.

To be specific, heat-treatment of shell presents no major problem so long as furnaces of modern design are employed. The lessons learned in mass-production heat-treating in the automobile industry the past decade will serve well in armament manufacture. Such developments as gas atmosphere furnaces, determination of proper time factors in heat-treatment, skin carburizing, design of conveyorized furnaces, and time quenching have already been worked out in connection with high-production heat-treatment and can be applied without extended experimentation to armament production.

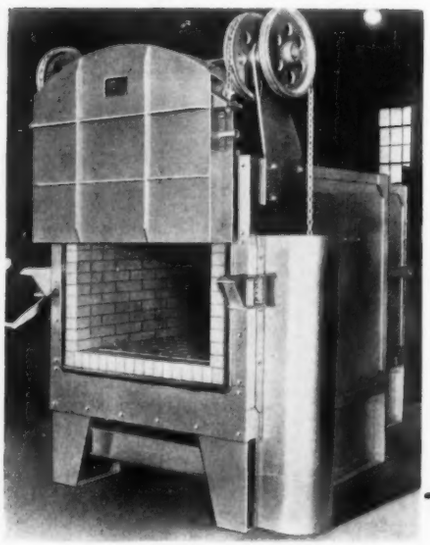
Problems common in shell manufacture during the last war will not be so troublesome in the months ahead, because steel mills long ago learned how to make better steel economically. Production of alloy steels has been mastered. Porosity and piping no longer are common defects of steel. Welding will be more extensively used than ever before, particularly in the assembly of various structures on a mass basis.

Much of the available experience of industry pertaining to welding, heat-treatment and metal-working in the defense program is outlined in the following editorial pages. For the visitor to the Show, the Show-in-Print Section will be a guide and a record. For the non-visitor it will tell what he would have seen had he attended. The special Armament Section is narrowed down to heat-treating and welding for defense production.

SHOW IN PRINT

New and improved equipment, accessories and materials on display at the National Metal Show in Cleveland, October 21-25

LINDBERG "CYCLONE" ELECTRIC TEMPERING FURNACE

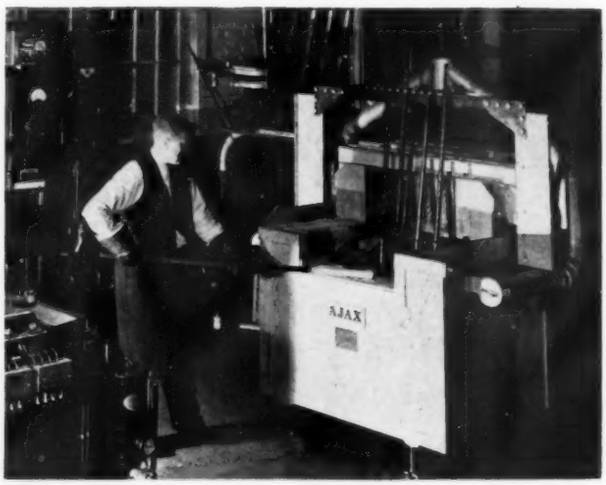


The "Cyclone" forced circulation box type electric tempering furnace developed by Lindberg Engineering Co., 221 N. Laflin St., Chicago, Ill., is of particular value in the heat-treatment of parts for the aircraft industry. These furnaces utilize a principle by which large volumes of accurately heated air are driven through the work under pressure and at velocities around two miles a minute. As a result heating is rapid, and every part of the charge is heated to the same temperature.

These furnaces are built in two types—the Toolroom model used for tempering, heating and preheating tools, dies and other small parts; and the Production box type, illustrated, built in larger sizes than the Toolroom type to accommodate heavy production loads such as large gears, forgings and aluminum and ferrous aircraft parts. In the Toolroom model, removable open grate shelves are provided, permitting easy passage of heated air through the charge. The Production type is normally supplied with a heavy cast grid on which the work can be loaded; however, sliding grids can be supplied as well as special handling means.

Door of the Toolroom model is of the plug type, while that for the Production model is of the counterweighted vertical lift type. Air-operated doors can be supplied. Heating elements are made of high grade nickel chromium wire wound into coils. Standard temperature ranges are from 200 to 850 F. for the Toolroom model and from 200 to 1,250 F. for the Production model. Four sizes of the Toolroom model and five sizes of the Production model are available.

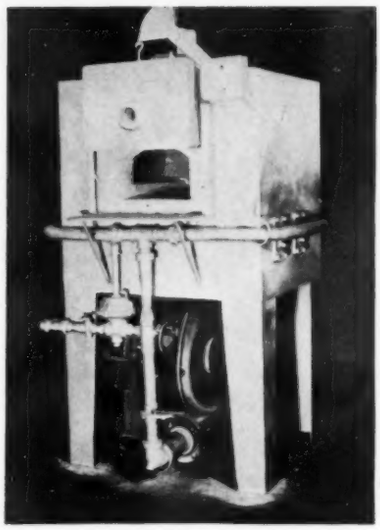
AJAX ELECTRIC SALT BATH FURNACE



Two entirely new applications for salt baths—brazing and heating for forging —are possible with the "Ajax-Hulgren" electric salt bath furnace made by Ajax Electric Co., Frankford Ave. & Allen St., Philadelphia, Pa. No heating elements are used in this furnace. Electrodes are closely spaced and placed at one side of the machine, out of the work-treating region, the electromagnetic forces providing constant forced circulation of the salt bath and insuring uniform temperature throughout.

Several advantages are claimed through the use of the electric resistance method of heating. A considerable saving of fuel cost results, since heat is released directly in the salt bath. Pot life is greatly extended since there is no flame impingement on outside walls. Greater uniformity of product is made possible by the automatic stirring action of the bath and by the fact that no current from the electrodes passes through the work to cause local overheating. Excessive salt decomposition is eliminated, thereby removing the difficulty of keeping the bath at the proper chemical balance. Flexibility of design is possible.

This type of furnace can also be used for carburizing, cyaniding, scale-free hardening, tempering, annealing and hardening of many types of steel articles. It is also applicable for the treating of aluminum alloy parts for the aircraft industry.



MAHR TOOL FURNACE

Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn., has developed a tool furnace especially to meet the demands for a low-cost furnace having positive combustion control. The combustion chamber is designed to give uniform heat throughout the hearth area at any temperature desired for any treatment of the various steels.

A special proportional air-gas mixer has a vernier control graduated for easy and quick setting. The operator can make a temperature chart of adjustments. He can also chart any number of specific processes for treatment of the various classes of material. The ratio can then be changed to either oxidizing or reducing at positive settings by movement of the vernier control. The record chart permits instant repeat settings for future operations.

This 12x18x6-in. gas underfired furnace is equipped with four premixed gas burners arranged for single-valve control. It has a graduated blast gate for primary setting to adjust for any class or grade of gas. It is lined with special quality refractory to give long service life. Frame is of all-welded steel construction. It can be furnished with or without blower.

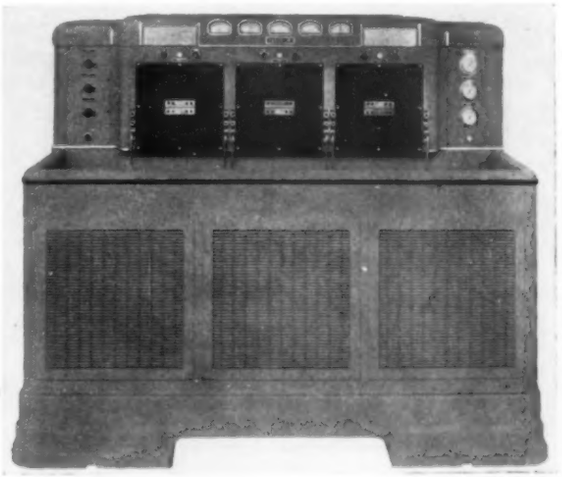
OHIO CRANKSHAFT "TOCCO JR." INDUCTION HARDENER

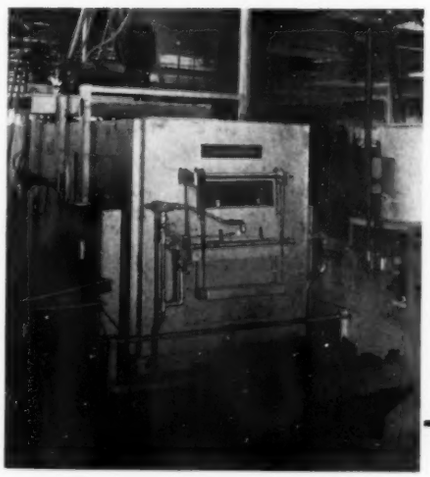
Available in capacities of 10, 20, 40, 60 and 80 kva., the Type MG 10 "Tocco Jr." induction hardening machine has been developed by Ohio Crankshaft Co., 6600 Clement Ave., Cleveland, Ohio, especially for the surface hardening of many small parts with the use of simple fixtures. Powered with self-contained 9,600-cycle generators, these machines can be furnished with one, two or three hardening stations. Any or all stations may be equipped with automatic feeding and handling devices.

Machine is versatile, compact and economical. It does not require a skilled operator. A replica of the large units except that it has all been put into a single package which can be placed in the production line, it can be easily moved from place to place as manufacturing changes demand.

Unit is furnished complete with: a motor-generator set for supplying high-frequency current to the induction heating device, a panel with complete instruments which indicate all essential control factors, an iron core water cooled transformer, a high-frequency circuit breaker which is the main switch between the generator and the inductor, and automatic cycle control. With this control the push of a button starts the cycle. The circuit breaker is closed and held closed for the predetermined time and the electrically operated quench valve is opened and held open for the predetermined time to produce an exact hardening cycle which is controlled within a fraction of a second. This eliminates the human element and insures absolute duplication of hardening cycles.

A sturdily built cabinet houses all equipment. Two high-capacity fans pull air through filters over the motor-generator and other parts to insure proper cooling with clean air. Cabinet is provided with a drain pan.





WESTINGHOUSE ELECTRIC FURNACE

Increased production and fewer rejections are claimed for an electric furnace for bright-hardening high-carbon and alloy steel airplane motor parts, developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. A continually moving belt conveyor in the furnace passes through an inert gaseous mixture known as "Endogas," which prevents decarburization. This gas, an inexpensive atmosphere produced by a special reaction with ordinary city gas, can be used to harden any S.A.E. steel without decarburization. Parts are discharged directly from the controlled atmosphere heating chamber into the quenching bath.

DESPATCH "CONTROLLED COMBUSTION" FURNACE

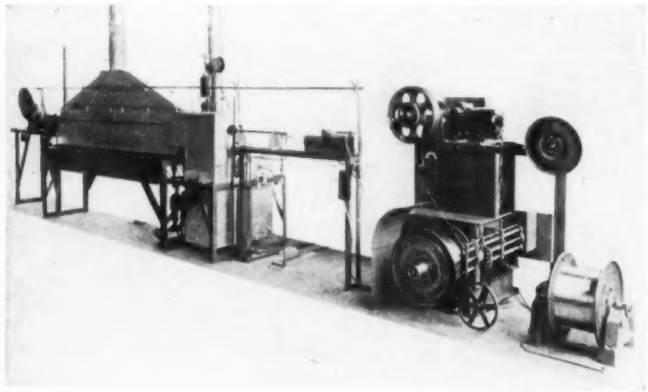
Despatch Oven Co., Minneapolis, Minn., has developed a forced-draft furnace having "controlled combustion," a new feature to assure the best gas consumption possible with an atmospheric type burner under all operating conditions. With "controlled combustion," the user is said to get more heat from the gas burned, and to get the heat into the furnace faster.

These furnaces are made in four standard sizes, and can be made in any special size to meet any particular requirement. They are available in two temperature ranges—one up to 850 F. and the other up to 1250 F.

SURFACE COMBUSTION "SYNCRO" ANNEALING UNIT

Developed jointly by Surface Combustion Corp., Toledo, Ohio, and Syncro Machine Co., 420 Lexington Ave., New York, N. Y., the "Syncro" open flame annealing and tinning unit has been especially built for high-speed tinning and annealing for the wire industry.

Standard machine is a six-strand unit, and machines can be furnished to accommodate any number of strands up to twenty. A visual indicator constantly shows degree of anneal taking place in each strand. A push-pull capstan controls the wire lines through the furnace, assuring proper tension and limiting the area reduction of the annealed wire to less than ½ of 1 per cent. Annealing furnace is of the direct flame, gas fired type, to provide economical, efficient and properly controlled heating. A chlorine fluxing agent rapidly and thoroughly cleans the wire prior to tinning. An advanced design of tin applier uniformly coats the wire. Tin is entirely inclosed under controlled atmosphere to minimize oxidation losses. A self-cleaning wiping device retrieves excess tin from the wire and burnishes it to a high lustre as it leaves the tinning zone.



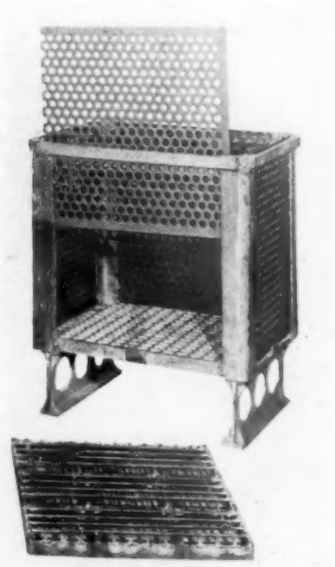
Quenching takes place in circulating water, and moisture is removed by an efficient vacuum wiper. Take-up is motor driven with wire tension control with a special magnetic slip clutch which also controls the traverse. Spool drive automatically maintains tension at which it is set throughout the filling of an entire spool, and this tension can be adjusted while the machine is in operation. Annealing units are available for installation ahead of enameling units to increase efficiency and improve quality by annealing and enameling wire in one operation.

JOHNS-MANVILLE "L-W SUPEREX" INSULATION

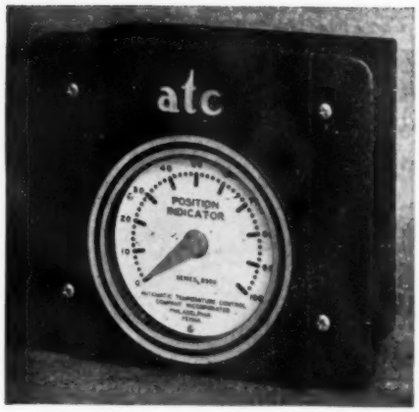
A 1,500-deg. insulating material, "L-W Superex," has been introduced by Johns-Manville, 22 East 40th St., New York, N. Y., to provide improved insulation and strength characteristics. Furnished in both block and pipe covering form, this material is suitable for use in industrial furnaces, ovens, kilns and other applications where the insulation will be subjected to temperatures between 600 and 1,500 F.

The insulation is of the molded diatomaceous silica type, weighing only 20 lb. per cu. ft. Blocks are furnished 3, 6, 9 and 12 in. wide in standard lengths of 18 and 36 in., in thicknesses from 1 to 4 in. Pipe insulation fits standard pipe sizes.

DRIVER-HARRIS "NICHROME" NORMALIZING BASKET



Among the recent developments of the Driver-Harris Co., Harrison, N. J., is a "Nichrome" (60 per cent nickel–13 per cent chromium) normalizing basket which has been specially produced for the heat-treatment of Garand rifle barrels. This basket consists of a cast "Nichrome" bottom, perforated sheet "Nichrome" slides, and hot rolled "Nichrome" wire and strip.



A.T.C. POSITION INDICATION SYSTEM

Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa., has made available a position indicator which operates on the Wheatstone Bridge principle and employs a patented rugged galvanometer relay. A small potentiometer-type rheostat is mounted on or near the body whose position is to be indicated and mechanically connected to this body by gears, links, sprockets or other convenient means. Upon any change in the body's position, the indicator follows immediately and registers the change on its large, easily read dial. Unlike other methods of remote position indication, the indicator cannot get out of step with the transmitter or change its pointer's position in case of power failure. There is virtually no limit to the distance between the transmitter at the moving body and the position indicator itself. Hand-operated transmitters may be used to give orders, values or information from a remote point.

PYROMETER INSTRUMENT "PYRO" PYROMETER

Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y., has developed two new optical pyrometers for accurate determination of high temperatures.

The "Bi-Optical" pyrometer, illustrated, a totally self-contained direct reading instrument, permits accurate temperature measurement without uncertain correction coefficients by simultaneous measurement of black body and actual or color temperatures. It employs light filters and color wedges which are transparent to a number of colors simultaneously. By using filters with a number of transparencies both for separation and for mixing and toning down, any complicated optical or mechanical device for the combination of colors is rendered superfluous and the creation of a simple temperature measuring device in the form of colored disks is made possible. The instrument is furnished with scale ranges from 950 to 2,000 C., or from 1,800 to 3,600 F.

The "Micro-Optical" pyrometer is a precision instrument for measuring at close range the temperatures of very small objects such as incandescent lamp filaments, and for laboratory and scientific research work. A 20-fold magnification of the object is provided by an efficient optical system. A precision ammeter with built-in battery is attached to the instrument, which operates on the principle of the disappearing filament. It is furnished with scale ranges of 600 to 1,600 C., 1,600 to 3,000 C., and 3,000 to 4,000 C., and equivalent F. ranges.

GENERAL ELECTRIC "DRYCOLENE" HEAT-TREATING GAS

"Drycolene," an atmosphere gas for heat-treating steels without surface decarburization, has been developed by General Electric Co., Schenectady, N. Y. This gas makes possible such operations as scale-free hardening, bright annealing, sintering and electric furnace brazing of high-carbon steels where surface decarburization, carburization or oxidation cannot be permitted.

The "Drycolene" producer is a gas-heated vertical cylindrical furnace containing an alloy retort filled with charcoal. It consumes hydrocarbon gases and heats the charcoal in the retort to a high temperature. The products of combustion are cooled to remove moisture, and then passed through the incandescent charcoal. The effluent gas, "Drycolene," which consists largely of carbon monoxide and nitrogen and is completely free of carbon dioxide, water and oxygen, is then ready to be delivered to the furnace without further treatment.

ARMSTRONG EASILY IDENTIFIED FIRE BRICK

Armstrong Cork Co., Lancaster, Pa., has introduced a system of color spots to identify the four types of high temperature insulating fire brick now in production. These spots, supplementing the regular brand stencil, provide easy and permanent identification, and minimize the possibility of error on the part of brick masons even when the stenciled name is hard to read. The distinctive color of Armstrong's fifth type of fire brick—N-16—establishes easily recognizable identity of this type without the use of a color spot.

BROWN "RADIAMATIC" PYROMETER

Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has developed a "Radiamatic" pyrometer for the measurement and control of temperature in applications where thermocouples are impractical or unreliable. This pyrometer is designed to operate under the severest service conditions.

Completely self-contained and compensated for ambient temperature errors, the "Radiamatic" detector is sighted on the hot object, moving or still, and continuously measures the temperature of the material itself. Heat radiated from the hot object is focused on a thermopile which generates an e.m.f. proportional to the true temperature. Desired e.m.f. alone is continuously indicated or recorded by the potentiometer.

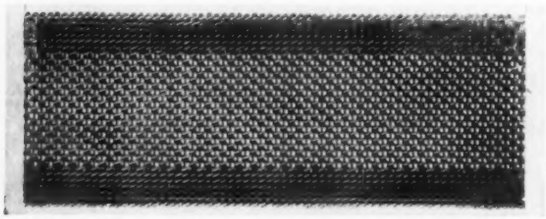
The pyrometer is built to withstand vibration, dust, dirt, fumes and corrosive atmospheres. Easily installed, it is recommended where vibration is present.

TAGLIABUE "CELECTRAY" INDICATOR

The "Celectray" self-balancing multiple-point indicator has been developed by C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y., especially for taking a great many temperature readings in a minimum time without personal errors resulting from fatigue. With the fastest model, readings can be taken every few seconds. A hairline indicator designed to minimize parallax increases readability. This, combined with precision balancing, provides an accuracy generally superior to hand balancing of portable potentiometers. An "in balance" signal is provided which lights while the indicating carriage is traveling from one point to the next, flickers while it steps into accurate balance, and stays out when it is time to take the next reading. If more than twelve points are required a separate switch box of the same design as the instrument case can be supplied for an almost unlimited number of points. A special arrangement of internal scale lighting can also be furnished.

CAMBRIDGE DUPLEX SELVAGE WIRE BELT

Cambridge Wire Cloth Co., Cambridge, Md., has developed a duplex selvage wire belt which is claimed to reduce operating cost on furnaces for copper brazing, normalizing, carburizing, hardening, bright annealing, silver soldering, spring tempering, and other heat-treating operations. This double selvage adds extra hours of service and offers freedom from operating difficulties by providing double strength at the point of greatest wear. Belts are available in a variety of meshes and wire gage combinations. They can be obtained in various alloys for operation in temperatures up to 2,100 F.



"AMPCO-WELD" ALUMINUM-BRONZE WELDING ROD

Ampco Metal, Inc., 3830 W. Burnham St., Milwaukee, Wis., has developed a versatile aluminum-bronze welding rod which meets the demand for a more readily handled rod and for stronger and longer-wearing welds. Known as "Ampco-Weld," this rod provides a weld metal having good bearing qualities, wear resistance, high fatigue strength and high impact strength.

In addition to operating efficiently and economically in repair work, the new rod can be employed in coating surfaces of large forming dies and other pieces of equipment to obtain longer die life and freedom from galling and scratching. In other large applications requiring a corrosion-resistant metal the foundation may be built up from cast iron or steel and then overlaid with this material, thereby reducing cost.

GENERAL ELECTRIC HIGH POWER FACTOR WELDER

General Electric Co., Schenectady, N. Y., has announced a line of 300-amp. a.c. arc welders offering advantages in performance and economy resulting from an electrical design which incorporates power factor correction. This built-in feature practically eliminates the useless lagging current drawn by convention designs. Hence, smaller primary cables, line switches and fuses can be used. This often results in a saving on installation costs and makes possible the addition of more welders to existing feeders without overloading.

When operated below half load, this welder provides leading reactive kva. for improvement of shop power factor. When operated at no load, there is 10.0 kva. available for this purpose.

Other advantages include finger-tip adjustment; a large, easily read current indicator; protected output terminals accessible through holes in the insulating panel; and fan-forced ventilation, providing cool, dependable operation even at high currents or high-duty cycles. The welder is only 43 in. high and 21 in. in diameter. Net weight is 450 lb.

PROGRESSIVE "FORGE-WELDING" PROCESS

"Forge-Welding" is a process of heavy-duty electric resistance welding for joining heavy ferrous sections heretofore considered impossible to weld with conventional equipment, developed by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. By this process, it is claimed that heavy work can be welded almost as easily and rapidly as spot welding sheet metal.

The process consists of first applying pressure to the work, then an interrupted current, and finally superimposing a hammering action on the electrode. Under high pressures and temperatures, work surfaces are brought into such intimate contact that when additional impact pressure and intermittent heat are applied a superior quality forged weld is obtained.

To secure the forging effect while holding the work under pressure a compound-action "Hydro-Booster" is used. Other special equipment required is of the accessory type, such as an automatic timer to control sequence of operations, and heat- and pressure-resistant alloy electrodes.

Spot size varies according to metal and thickness. On work totalling $1\frac{1}{2}$ in. thick the spot will usually be approximately 1 in. in diameter near the surface.

PAGE-ALLEGHENY STAINLESS STEEL WELDING ELECTRODES

Page Steel & Wire Div. of American Chain & Cable Co., Monessen, Pa., offers Page-Allegheny stainless steel welding electrodes coated with formula No. 473-22. With this coating, electrodes are claimed to hold an extremely smooth arc with practically not spatter. Deposited metal is extremely fluid when molten, resulting in a very smooth weld surface which is bright and clean.

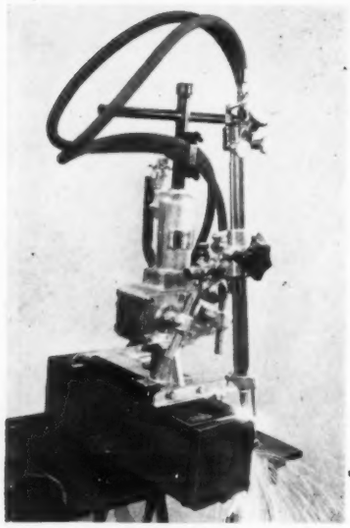
For gas welding on stainless steel, Page "Hi-Tensile M" gas wires are also available. These wires are claimed to give a strong, ductile weld with no air hardening or embrittling, and which will respond excellently to heat-treatment.

GENERAL ELECTRIC 25–250-AMP. d.c. ARC WELDER

A d.c. arc welder which will provide any welding current from 25 to 250 amp. has been developed by General Electric Co., Schenectady, N. Y. This wide range allows all-day manual welding to be done with currents up to 200 amp., using electrodes from $\frac{1}{16}$ to $\frac{5}{16}$ in. in diameter. Capacity is also provided for use of electrodes as large as $\frac{1}{4}$ in. on occasional short jobs.

Welder has two outstanding features. First, it provides for instant recovery of voltage to an extent greater than the arc voltage after each short circuit, thus preventing time-wasting arc popouts. Second, it never allows current peaks to exceed three times the steady short-circuit current on any adjustment, thus preventing excessive heat and spatter and resulting in a saving of electrodes. Other advantages include self-excitation and welding current quick adjustment.

LINDE "OXWELD" BAR CUTTING MACHINE



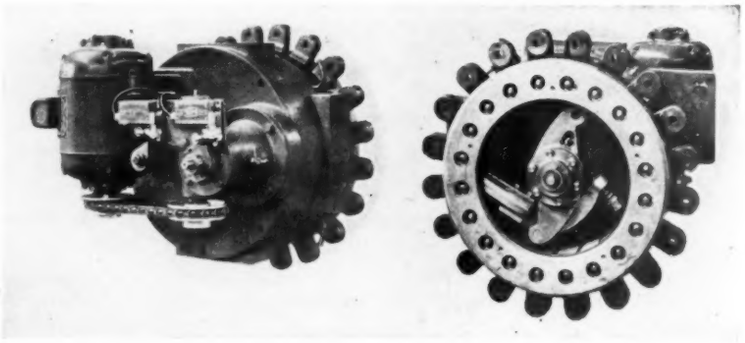
An oxyacetylene bar-cutting machine designed for a number of steel mill cut-off operations has been developed by Linde Air Products Co., a unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y. This portable device, known as the "Oxweld" CM-35 bar-cutting machine, will cut rounds or squares with a minimum of adjustment. It is driven by a self-contained spring-power unit, the speed of which is hydraulically controlled.

Machine is simple in operation, the correct motion for cutting either rounds or squares being transmitted positively to the blowpipe by an easily adjusted linkage. Hydraulic control provides smooth blowpipe travel with an almost infinite variation of cutting speeds between 1 and 75 in. per min. Self-contained power unit offers the additional advantage of increased portability. The machine can be used indoors or out, wherever oxygen and acetylene are available, and can be moved to a new workplace at a moment's notice, since neither electric power nor guide track is necessary. With standard equipment it has a cutting range of from 2 to 10 in. This range can be changed, however, to 8 to 15 in. by special linkage arms which are installed easily.

TAYLOR-WINFIELD "ULTRASPEED" WELDER SWITCH

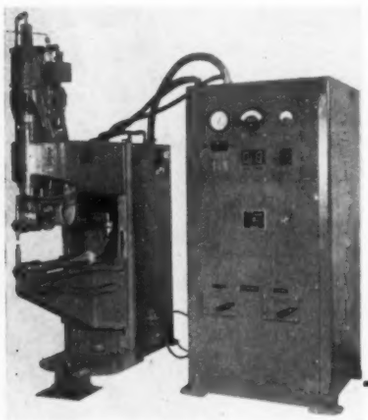
The "Ultraspeed" rotary type of welder switch developed by Taylor-Winfield Corp., Warren, Ohio, shortens the welding cycle by returning to its starting position by virtue of its circular construction, thereby eliminating reversing motor control necessary on straight-line action devices.

In operation, the motor drives the brush-holder rigging through a worm gear reducer and Geneva motion, thus indexing the brush from one segment to another. Welds are made while the brush is stationary on the commutator section, thus eliminating transmission of heavy currents while the brush is moving. Main distributor ring, located immediately behind the commutator ring, transmits current to the commutator segments by a brush of laminated silver-plated copper construction. A cam-operated limit switch automatically stops the device after one cycle is complete. Rotary design eliminates reversing.



TAYLOR-WINFIELD "HI-WAVE" SPOT WELDER

The "Hi-Wave" welder offered by Taylor-Winfield Corp., Warren, Ohio, is claimed to introduce a radically new system of spot welding. Intensive research is said to have resulted in the development of a complete line of equipment for producing spot welds in aluminum alloys of a quality which cannot otherwise be duplicated. While it has been developed primarily for welding aluminum alloys, it is applicable to steel, and non-ferrous metals.

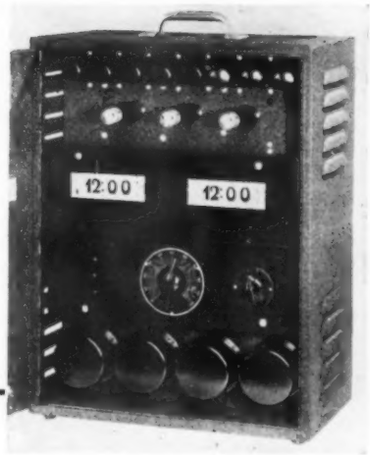


Equipment consists of a conventional type spot welder with an entirely different transformer. Principal welder refinement is increased rigidity to prevent any possibility of electrodes skidding during welding. Control panel includes a bank of capacitors, charging transformer, rectifier, and the necessary relays.

In operation, three-phase a.c. is passed through the transformer and rectifier, charging the capacitor bank. When this bank is fully charged, the current is automatically cut off and the machine is ready for discharging across the weld. As soon as the points are in contact with the work and full pressure has been developed, relays discharge the capacitors through the welding transformer, generating a secondary current discharge through the work. This discharge is a single wave of a few microseconds' duration. Length, amplitude and shape of the wave—which have a marked bearing on weld quality—are predetermined by the control apparatus. Since the capacitors are charged with the electrodes separated, no time is lost during the charging cycle.

Power demand for this type of equipment is roughly 10 per cent of that of conventional welders. Another advantage of the "Hi-Wave" system is comparative freedom from pickup. Runs of 500 welds are claimed to be easily made without the necessity for cleaning tips.

HARRIS-KINKEAD "MASTER MIND" WELDING CHECKER



On display in the booth of the Harris Calorific Co., Cleveland, Ohio, the electric "Master Mind" has been developed in conjunction with Robert E. Kinkead, consulting engineer, for determining the quality of arc welds while they are being made. It can also be used to check automatically the ability of a welder at the time he is being considered for employment, to serve as an automatic instructor when training new operators, to provide means for definitely checking joint preparation methods, and to supply accurate data for time study work.

The device records how well an operator performs his job while the work is actually in process. Red and green lights on the control instrument and in the head shield indicate weld quality. Recording instruments on certain models permit time study information to be obtained, and enable manufacturers to certify their arc welding on special jobs with close specifications.

WALL COLMONOY HARD-FACING ALLOYS

Wall Colmonoy Corp., 636 Buhl Bldg., Detroit, Mich., has developed three new hard-facing alloys for application with the oxy-acetylene flame. "Colmonoy" No. 4 provides a hardness of approximately 35–40 Rockwell C, with an abrasion resistance suitable for repairing die-casting molds, body draw and forming dies, and various other parts which require abrasion resistance and machinability. "Colmonoy" No. 5 is similar to No. 4, but has a hardness of 45–50 Rockwell C. This alloy is used for pump sleeves, wear rings, plungers and parts which receive considerable combined corrosion and abrasion. It can be machined with tungsten carbide tools.

"Colmonoy" No. 9 combines great hardness and toughness. As applied with the oxy-acetylene flame or as cast, and without heat-treatment, its hardness ranges from 65–68 Rockwell C. Its red hardness is also high, making it suitable for application to tools and dies which must retain hardness at elevated temperatures. The melting point is sufficiently low to permit its application to various tools without danger of coarsening the adjacent grain structure. Since it is an iron base alloy, its use in places where corrosion resistance is necessary is not recommended. It can be used with excellent results for tipping tools.

"MUREX" WELDING ELECTRODES

Metal & Thermit Corp., 120 Broadway, New York, N. Y., has announced several additions to its "Murex" line of electrodes for metallic arc welding.

Heavy coated electrodes are now available for a wide variety of services, including both a.c. and d.c., as well as positioned and non-positioned work, on mild steel and a number of high strength, low alloy steels such as Cor-Ten, Man-Ten, Sil-Ten, Mayori, Republic Double Strength, nickel steels and stainless steels. The outstanding feature of these electrodes is said to be their ability to operate at unusually high amperages with a minimum of spatter, thus speeding welding operations and reducing cleaning costs.

CROWN "ROTO-FINISH" BARREL

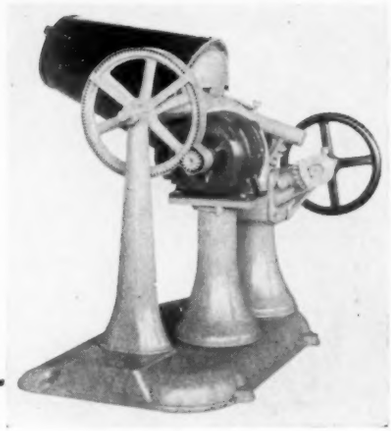
A double cylinder "Roto-Finish" barrel has been developed by Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill., especially for the new Sturgis "Roto-Finishing" Process, which is a tumbling process for finishing die castings and stamped metal parts of stainless steel, brass, and other similar materials. It is claimed that in many cases a finish equal to that obtained by hand buffing operation can be obtained. One of the main features of the barrel is the ease of loading and unloading of all four compartments.

OAKITE CLEANING COMPOSITIONS

Two more compositions for efficient metal cleaning have been developed by Oakite Products, Inc., 22 Thames St., New York, N. Y. Composition No. 54 B is intended specifically for electrocleaning polished steel and buffed copper before plating. It is said to completely remove all smut on many different types of work in a single operation, thereby eliminating the necessity of degreasing, presoaking, applying emulsifying solvents, or mechanical scrubbing.

Composition No. 27 is a versatile, heavy-duty cleaning material which, because of its special colloidal and solvent absorption action, its extra wetting ability and improved rinsing qualities, can be used either as a still tank cleaner or as an electro-cleaner. It is also highly suitable for cleaning before vitreous enameling and other coating processes.

GLOBE TILTING TUMBLING BARREL

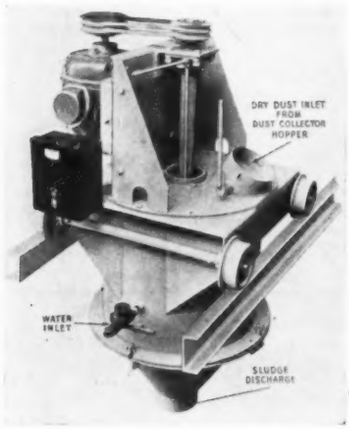


Globe Machine & Stamping Co., 1250 W. 76th St., Cleveland, Ohio, offers a line of motor-driven tilting tumbling barrels for finishing parts difficult to burnish or polish in the usual way. A special work-shifting bottom promotes tumbling action and cuts tumbling time.

Operator does not have to stop the machine and remove a cover for filling, inspecting or emptying. He can remove samples merely by reaching in, and can change the angle at any time to intensify or slacken tumbling action. Thus he can be sure exactly when to stop. He can empty contents into a receptacle merely by turning a handwheel.

These barrels remove burrs, fins, flash, scale, roughness, rust, oil, grease, sand and dirt. They handle such materials as steel, cast iron, aluminum and brass. They finish stampings, castings, forgings, screw machine parts and similar items. Barrels can be furnished with steel, cast iron, cast brass, wood, Monel or stainless steel shells. Of simple, rugged construction, they are available in five sizes.

"AMERICAN" WET DISPOSAL UNIT



The wet disposal unit offered by American Foundry Equipment Co., 581 South Byrkit St., Mishawaka, Ind., is designed for wetting and mixing with water the collected dust discharged from hoppers of cloth filter type or other dry types of dust collectors.

Heretofore dry dust disposal has necessitated more than ordinary care in handling. The wet type dust collector eliminates the disposal problem, but these devices are relatively inefficient in dust collection as compared with a cloth type collector. The combined use of the cloth type collector with the wet disposal unit gives maximum over-all dust collecting efficiency.

The "American" wet disposal unit is a self-contained mixer which receives dry dust from the collector hopper and deposits it near the center of a high-speed mixing disk. At the same time, water or other liquid is discharged at the center of the disk. The speed and shape of the disk cause an instantaneous mixing of the dust and liquid and the mixture flows from the sludge discharge at the bottom of the unit. The amounts of dust and water are constantly under the control of the operator, allowing any mixture desired. The unit will handle dust approximately as fast as the hopper can be unloaded dry.

BRADLEY CLAD STAINLESS WASHFOUNTAINS

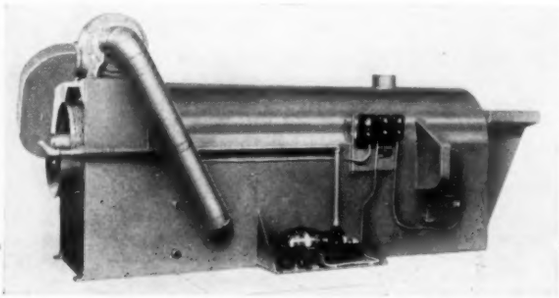
Washfountains offered by Bradley Washfountain Co., N. 22nd and W. Michigan Sts., Milwaukee, Wis., which have long been available in stainless steel, are now made in clad stainless. Like the solid stainless units, the bowls of these fountains are one-piece pressings having pedestals of Bonderized mild steel finished in baked enamel to match.

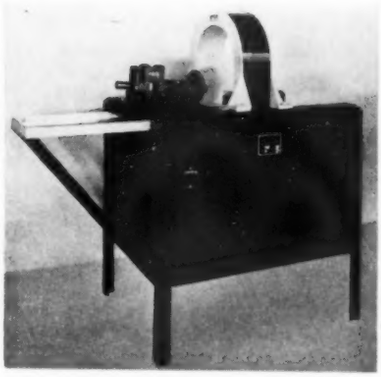
Bowls have an 18-8 stainless steel surface approximately 0.028 in. in thickness bonded to a mild-steel base. Fixtures are available in circular and semi-circular models, 54 and 36 in. in diameter. They afford all the advantages of other washfountains in installation, operation, sanitation and, also, are appreciably lower in first cost than solid stainless fixtures.

RANSOHOFF DRUM TYPE WASHER AND DRYER

N. Ransohoff, Inc., W. 71st St. at Millcreek, Carthage, Cincinnati, Ohio, is offering the No. 725 continuous drum type washing and drying machine for cleaning many types of metal parts. This machine consists of a soak wash, spray wash, drain and dry, the work passing continuously from one section to the next. In its course the work is gently agitated but never dropped, so that delicate work can be readily handled without injury.

The solution in the tank is heated by a gas burner burning in submerged serpentine flues. Work is dried by air which is blown onto it through holes in a pipe which extends through the center of the drum, the air being heated by the exhaust from the gas burner. Solution is sprayed onto the work from a pipe which extends through the center of the drum and is circulated by a motor-driven pump. The drum is rotated by a geared-head motor, mounted to automatically provide take-up on the driving chain.





MAGNAFLUX DEMAGNETIZER UNITS

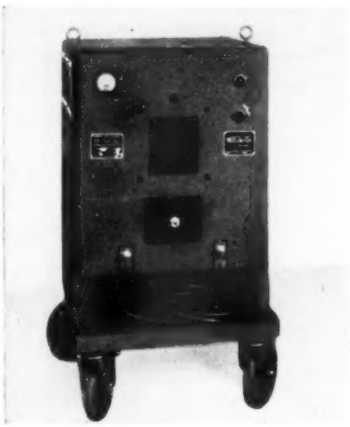
Type SB demagnetizers, developed by Magnaflux Corp., 5916 Northwest Highway, Chicago, Ill., especially for use with d.c. Magnaflux inspection units, are made in openings of 5x7, 9x11, 14x16, and 28x14 in. The 5x7-in. size is made for bench mounting, the 9x11-in. size is mounted on its own stand, while the two larger sizes are mounted on their own stands and equipped with a conveyor track and roller carriage for easy handling of heavy parts.

Outstanding improvements over previous models include approximate doubling of demagnetizing efficiency, and a great reduction in the length of the coil, which reduces space and makes for easier operation. Units are furnished either with hand switch or with an automatic timer.

RANSCHOFF CONVEYOR TYPE WASHER AND DRYER

The No. 64-N conveyor type washing and drying machine developed by N. Ranschoff, Inc., W. 71st St. at Millcreek, Carthage, Cincinnati, Ohio, is intended for cleaning parts which cannot be put through drum type machines.

In this unit cleaning compound is sprayed onto the work through countersunk holes in transverse pipes located both above and below the conveyor. Ends of the pipes extend through the side of the machine to provide for easy cleaning and proper setting of sprays. Before returning to the tank the solution passes through removable baskets which screen out chips and other foreign matter removed from the work. Oil and scum are floated off over a skimming dam located in this same extension. Solution in the tank is heated by gas, burning in submerged serpentine flues. This machine has no dryer section, but one can readily be incorporated where the nature of the work makes one necessary.



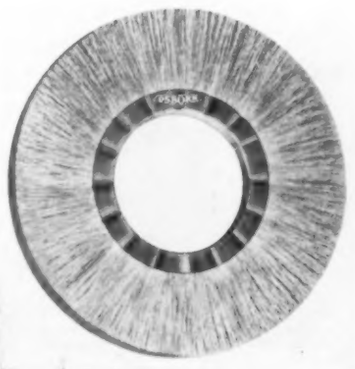
MAGNAFLUX INSPECTION UNIT

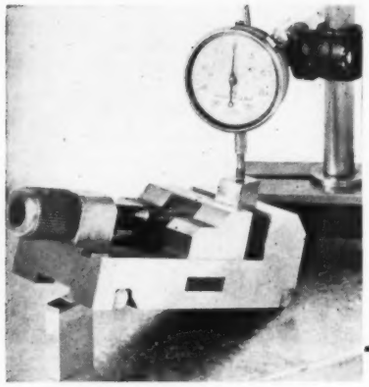
The Magnaflux Corp., 5916 Northwest Highway, Chicago, Ill., has developed a portable inspection unit particularly adapted to the inspection of welds. Identified as the KQ-1, it operates from 220- or 440-volt, three-phase, 60-cycle a.c., and delivers full-wave rectified current. Output current is up to 600 amp. d.c. for continuous service, and up to 1,200 amp. may be drawn intermittently. Remote control is provided so that one-man operation is possible. This unit is also made in the Type KQ-04, which delivers up to 400 amp. d.c.

Both units are sturdily constructed, with heavy 8-in. composition swivel casters for easy handling around the shop. They are claimed to give very sensitive results in the location of both surface and subsurface defects.

OSBORN "RINGLOCK TAMPICO" SECTION BRUSH

An outstanding development of the Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio, is the "Ringlock Tampico" section power-driven brush. This construction locks in the fiber by a one-piece ring and sleeve, thereby reducing breakage and shedding. Several types and sizes of this new design of power-driven brush are available for various industrial applications.





MARBURG "ANGLEMASTER" SINE VISE

Marburg Bros., Inc., 90 West St., New York, N. Y., has developed the "Anglemaster" sine vise to serve both as a rugged tool and a precision gage. Made of suitable steel, heat-treated and seasoned before finishing, this device quickly and accurately handles angle grinding, inspection and layout.

Precision sine rolls permit accurate angle setting. In grinding, ordinary magnetic chucks will hold the device at any angle by means of a size block or planer gage. The non-projecting telescoping screw provides pressure to the slide jaw where it is most effective. Knurled screw knob, held in place by an internal spring, is easily detached after work is correctly set, insuring against accidental changes in set-up.

Specifications: Length over-all, 6 in.; length between sine rolls, 5 in.; depth of jaws, 1 in.; jaw travel, 3 in.

IMPROVED CARBOLOY ROUND HOLE DIES

Availability of standard Carboloy round hole dies for drawing sizes of bar and tubing up to 3½ in. in diameter, and improvements in construction in the larger series—R7 to R16—of standard drawing dies, have been announced by Carboloy Co., 11149 E. Eight Mile Rd., Detroit, Mich. Tendency to use cemented carbide dies for larger sizes of bars and tubing has led to the introduction of the R-18 type as a standard Carboloy die. Nib dimensions of the die are 5.50 in. diameter by 2.125 in. height, with a casing dimension of 9 x 3¾ in. It is designed for drawing work ranging from 2¾ to 3½ in. in diameter.

In addition, "cored" dies previously available only in the smaller—R1 to R6—series, are now also available in the series R7 through R10, for drawing fractional sizes of bar and tubing from $\frac{5}{16}$ to ¾ in. diameter.

Principal improvement in the larger series of dies, from the R-10 through the R-16, is a material increase in nib size to provide a longer bearing for easier push start bar-drawing and tube-sinking. Increases in height for the various dies range from $\frac{1}{16}$ to $\frac{3}{8}$ in. Recent price reductions apply to these dies.

AMERICAN "CYCLONE" DUST COLLECTOR

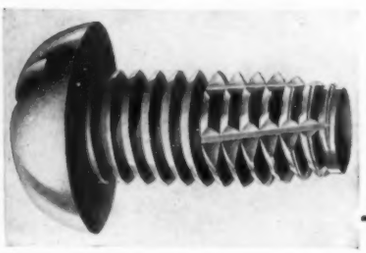
American Foundry Equipment Co., 580 South Byrkit St., Mishawaka, Ind., has developed its "Cyclone" type of dust collector to provide unusually high efficiency in separating dust from air.

In operation, dust is separated from air stream by centrifugal force. Careful proportioning of the unit results in unusually high efficiencies with relatively low back pressure. Air volume can be varied from rated capacity to a great extent without seriously affecting efficiency. The unit can be built in various sizes to suit requirements.

BALDWIN-SOUTHWARK "METALECTRIC" STRAIN GAGE

Both static and dynamic types of the SR-4 bonded "Metalectric" strain gage have been made available by Baldwin-Southwark Div. of Baldwin Locomotive Works, Philadelphia, Pa. The static type will measure a stress of as little as 20 lb. per sq.in. in steel, and the dynamic model will handle frequencies up to 30,000 cycles per second.

PARKER-KALON SELF-TAPPING SCREW



Parker-Kalon Corp., 200 Varick St., New York, N. Y., has developed the Type F self-tapping screw especially for use in materials of a crumbling or granular nature such as cast and malleable iron. The tap-fluted pilot of this screw makes it capable of truly cutting a thread in the material as it is screwed in. The thread is so designed that, if necessary, a standard machine screw of corresponding size may be screwed into the thread formed by the screw. The Type F screw can also be used with a standard nut where an auxiliary fastening is required. It can be driven with any type of screwdriver—hand, spiral, portable, electric or air.

de SANNO ABRASIVE CUT-OFF MACHINES

An entirely new abrasive cut-off machine and an improvement on an older model have been made available by A. P. de Sanno & Son, Inc., Phoenixville, Pa.

The new Type M machine, for dry-cutting only, is of the heavy-duty bench type, and is designed to meet the demands for a machine which will cut heavier stock than the lighter machines and yet fit in the price range between the lower-priced machines and the high-priced ones. It uses a 12-in. diameter disk measuring $\frac{1}{16}$, $\frac{3}{32}$ or $\frac{1}{8}$ in. in thickness, driven from a 5-hp. motor through a multiple V-belt drive. The machine is provided with two sets of interchangeable wheel flanges, and has a special angular depth adjustment with quick acting locking device and a special quick-acting work clamp. Vise opens to $2\frac{1}{2}$ in.

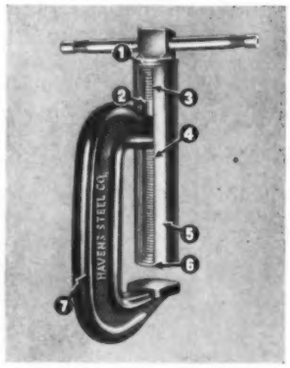
The old Type J machine has been improved to use an 18-in. disk in place of the former 16-in. disk, and a 10-hp. motor replaces the former $7\frac{1}{2}$-hp. motor. These changes provide larger capacity.

WESTINGHOUSE "K-42-B" HIGH TEMPERATURE ALLOY

Developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., the "K-42-B" alloy, though containing only 7 per cent iron, is claimed to be stronger than any known steel and to retain its strength at temperatures over 2,000 F.

This alloy is stronger at 1,100 F. than ordinary low-carbon steel is at room temperature, and has a low damping coefficient. Almost half of it is nickel; about a quarter is cobalt. It has other components including chromium, titanium and iron. Immediate uses are expected to be those of a special-purpose alloy for dies, turbine blades, and applications needing temperature-resistant metals.

The alloy creeps a great deal less than other metals in its class. In tests it showed a yield of only 0.0001 in. for each inch of length, and most of this had taken place during the first few hours. Under the same conditions a sample of high-strength nickel-chromium steel yielded 100 times as much.



SCULLY "HAVENS" PROTECTED C CLAMP

The "Havens" protected C clamp offered by Scully Steel Products Co., 1319 Wabansia Ave., Chicago, Ill., has been specially designed for welding shops. The shield or strong compression sleeve protects threads from damage and prevents weld spatter from clogging the threads. These clamps are made in shallow throat, medium throat and deep throat, in an assortment of sizes.

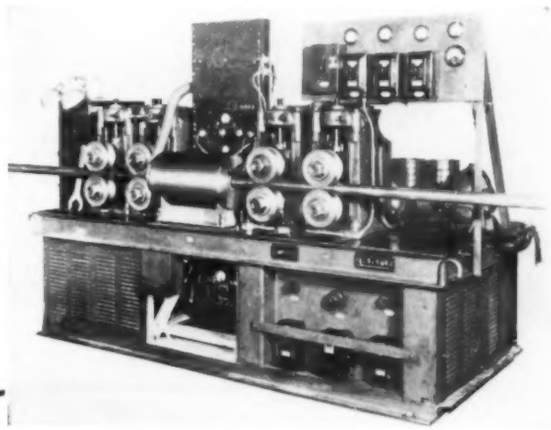
SPERRY ELECTRIC TUBE DEFECT DETECTOR

Several years of extensive research have culminated in the development of a non-destructive electric tubing defect detector by Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J. With this machine, tubing having either magnetic or non-magnetic properties can rapidly be inspected for many types of flaws.

In operation, the tubes are fed automatically at a constant speed through the detection coils of the machine. Presence of a defect operates a signal lamp and at the same time immediately stops the tube feed. This equipment operates independently of the tube manufacturing process, and thus permits testing of tubes of different sizes and gages as a separate operation. The testing equipment is easily handled by one operator.

Types of defects which the machine will detect include surface flaws, checks, cracks, and slivers on both the internal and external surfaces; discontinuous defective welds, and long laminations. It is also useful in detecting "cupping" in lengths of bar stock.

The detector is compactly constructed and may be conveniently located in any tube mill. Simple and efficient operation is facilitated by table mounting of amplifiers, energizing and detector coils, drive rolls and controls. Underneath the table are mounted a motor-generator set for supplying the energizing current, the roll drive motors and other related parts.



CAMPBELL NIBBLING MACHINE

The No. 250 nibbling machine offered by Andrew C. Campbell Div. of American Chain & Cable Co., Bridgeport, Conn., features adjustable stroke, wide stock cutting, and three speeds. It is capable of cutting up to $\frac{1}{4}$-in. thick mild steel and $\frac{1}{8}$-in. thick stainless steel in widths up to 70 in. Throat depth of the unit is 36 in.

Stroke is adjustable so that it can be regulated to the thickness of the metal being cut. Adjustment is made by removing drive pin and turning shaft to pin holes which are located in such a way as to provide at least three strokes. Change from one stroke to another can be made in less than one minute. Speeds of 350, 500 and 800 r.p.m. are provided by a V-belt drive and step pulleys at the rear of the machine.

SCULLY HOT MARKING "PAINTSTICK"

The "Paintstick" for hot-marking metal slabs, offered by Scully Steel Products Co., 1319 Wabansia Ave., Chicago, Ill., has been made available in different grades. One is for marking at temperatures between 150 and 850 F., and another for marking at temperatures between 350 and 1,400 F. Both grades are supplied in two types. One type, the S-2, is not weatherproof, while the other type, W-2, is weatherproof. All are available in many different colors.

PHYSICISTS RESEARCH PROFILOMETER ACCESSORIES

Physicists Research Co., 343 Main St., Ann Arbor, Mich., has developed two accessories for the profilometer which extend the practical applications of the instrument, which itself has also been somewhat modified.

First accessory, the "Mototrace," moves the tracer across the surface to be measured. It has four specific applications: when the tracer is on very narrow surfaces or small areas where the available tracing distance is only $\frac{1}{32}$ to $\frac{1}{8}$ in.; in awkward places near shoulders and holes, where the tracing distance is restricted on very smooth surfaces; where extraneous vibration makes manual tracing difficult; and in small holes or other surfaces measured with the Type I tracer described below. Two motions are provided. The first is a constant-speed linear motion, automatically reversing at both ends. Stroke is adjustable from $\frac{1}{4}$ to $2\frac{1}{4}$ in. The second motion is a cam-driven constant-speed quick-reversal reciprocating motion, adjustable from $\frac{1}{64}$ to $\frac{1}{8}$ in.

Other accessory, the Type I special tracer, has been developed for measuring roughness inside holes as small as $\frac{1}{2}$ in. in diameter. A modification for even smaller holes can also be furnished on special order. This tracer is also useful for measuring roughness of gear teeth and other difficult-to-reach surfaces. Close spacing of the pilot skids of this tracer makes it desirable to use the "Mototrace" described above for most applications.

A special Profilometer, with a one-micro-inch scale, can now be furnished. The most sensitive scale on the standard Type P instrument is three microinches. On especially fine work greater sensitivity is required. This special model incorporates an additional point on the range switch, giving three times the sensitivity of the standard model. Except for this modification it is identical in size and appearance with other Profilometers.

STANLEY ELECTRIC HAND AND TOOLPOST GRINDER

Stanley Electric Tool Div. of the Stanley Works, New Britain, Conn., has developed a compact grinder designed for both hand and lathe grinding. Known as the No. 153 grinder, this tool is nicely balanced for hand use, and with a motor holder can be mounted in a lathe, milling machine or shaper for external or internal grinding on dies, punches, cutters and machine parts.

A $\frac{3}{8}$-hp. motor turns the spindle at 18,000 r.p.m. through a direct drive. Mounted on ball bearings, it has ample power to drive grinding wheels up to $1\frac{1}{4}$ in. in diameter. Extended shaft gives a reach of 5 in. for deep internal grinding, and the long spindle housing provides a good grip for hand grinding. Grinder is furnished with a chuck for $\frac{1}{4}$-in. shanks. It may be supplied in voltages of 115, 125, 150, 220, 230 or 250 as required.

EXHIBITORS

National Metal Exposition

PUBLIC AUDITORIUM, CLEVELAND, OHIO, OCTOBER 21-25, 1940

Acme Electric Welder Co., (B-32). Spot, projection, butt, flash and seam welders.

Advance Polishing Wheels, Inc., (Y-16). Polishing and buffing wheels.

Air Reduction Sales Co., (G-20). Welding and cutting torches, brazing and hard facing apparatus.

Ajax Electric Co., Inc., (B-38). Ajax-Hultgren furnace demonstrating salt bath dip brazing.

Ajax Electrothermic Corp., (B-38). High frequency furnaces, induction methods for heating bar stock.

Allegheny Ludlum Steel Co., (A-1). Stainless steels, tool steels, nitralloy.

Allis-Chalmers Mfg. Co., (Z-231). Electronic arc welders, centrifugal pumps, electric motors and Texrope drives.

Alox Corp., (F-8). Corrosion preventive compounds, and lubricating materials.

Aluminum Co. of America., (D-22). Aluminum and aluminum alloy products.

American Brake Shoe & Foundry Co., (F-35). See American Manganese Steel Co.

American Brass Co., (E-22). Copper and brass products, flexible metal hose and tubing.

American Car and Foundry Co., (E-26). Electric bar heaters, forging heaters and rivet heaters.

American Chain & Cable Co., (G-4). Nibbling machines, die sets, welding wire.

American Cyanamid & Chemical Corp., (A-5). "Aerocarb" carburizing compounds, "Aerocase" case hardening compounds.

American Foundry Equipment Co., (Z-101 and X-105). Wheelabrator cleaning equipment.

American Gas Furnace Co., (M). Heat-treating furnaces and burners.

American Gasifier Co., (Z-127). Heat-treating unit.

American Machine and Metals, Inc., Riehle Testing Machine Div. (Y-22). Testing machines.

American Magnesium Corp., (D-22). Magnesium alloys.

American Manganese Steel Co., (F-35). Chromium-nickel alloy castings.

American Rolling Mill Co., (E-16). Iron and steel sheets; specialty steels.

American Screw Co., (C-31). Bolts and screws.

American Steel & Wire Co., (Z-104). Wire and rods, stainless and cold finished strip.

Ampco Metal, Inc., (Y-26). High strength non-ferrous alloys for dies, bushings and wear strips.

Anderson & Sons, (E-10). Etched and lithographed metal products.

Arcos Corp., (C-27). Welding rods, accessories.

Armstrong Cork Co., (C-8). Fire brick and cements.

Audubon Wire Cloth Corp., (H-12). "Metallwove" screens, conveyor fabric and wire cloth.

Automatic Mfg. Co., Inc., (Y-11). Piercing machines.

Automatic Temperature Control Co., Inc., (H-31). Temperature control equipment.

Babcock & Wilcox Co., (Y-54). Fire brick.

Baker & Co., Inc., (F-15). Precious metals.

Baldwin-Southwark Div., The Baldwin-Locomotive Works, (B-27). Universal testing machines.

Barrett-Cravens Co., (E-4). Industrial trucks.

Bastian-Blessing Co., (H-40). Oxy-acetylene equipment.

Bath & Co., Cyril, (Z-130). Bending presses.

Bausch & Lomb Optical Co., (C-14). Optical instruments for metallography and spectrography.

Bethlehem Steel Co., (A-22). Carbon and alloy steels, tool steels, strip and wire.

Blakeslee & Co., G. S., (H-7). Cleaning machines.

Borg Warner Corp., (C-9). See Ingersoll Steel & Disc Div.

Bradley Washfountain Co., (Z-212). Washfountains.

Bridgeport Brass Co., (Y-27). Brass and copper.

Bristol Co., (G-7). Pyrometers, temperature recording and controlling equipment.

Brown Fintube Co., (G-11). Heat transfer parts.

Brown Instrument Co., (F-4). Indicating, recording and automatic control instruments.

Bruning Co., Inc., Charles, (F-40). Drafting and surveying equipment and supplies.

Brush Beryllium Co., (Z-235). Beryllium alloys.

Brush Development Co., (Z-235). Device for measuring surface smoothness.

Buehler, A. I., (Y-20). Metallorgraphic and laboratory equipment.

Burdett Mfg. Co., (M). Industrial Gas Exhibit. Welding and cutting apparatus, gas burners.

Cambridge Wire Cloth Co., (C-24). Wire cloth and screen conveyor belts, mesh baskets.

Campbell Div., Andrew C., American Chain & Cable Co., Inc., (G-4). Abrasive cut-off machines, "Cutamatic" nibbling machines.

Carboloy Co., Inc., (Z-115). Cemented carbides.

Carborundum Co., (E-32). Abrasive materials, refractories.

Carnegie-Illinois Steel Corp., (Z-104). Carbon and alloy steels, high-tensile steels.

Carpenter Steel Co., (E-27). Tool steel and stainless steel.

Chapman Valve Mfg. Co., (Y-13). Chapmanizing process for heat-treating.

Chase Brass & Copper Co., (C-21). Copper and brass alloys, welding rods, fabricated products.

Chicago Flexible Shaft Co., (I-7). Heat-treating furnaces.

Chicago Malleable Castings Co., (I-38). High-strength "Super-Y" castings.

Cities Service Oil Co., (Z-244). Lubricants and cutting oils.

Clark Controller Co., (E-28). Electric control equipment and accessories.

Clement Diamond Tools Co., (G-39). Diamonds and diamond tools.

Cleveland Crane & Engineering Co., (Z-130). Bending presses.

Cleveland Wire Spring Co., (Z-216). Springs and special wire shapes.

Climax Molybdenum Co., (E-14). Molybdenum steels and irons.

Coffing Hoist Co., (G-23). Electric, chain and ratchet lever hoists.

Commerce Pattern Foundry & Machine Co., Upton Electric Furnace Div., (Y-33). Electric salt bath furnaces.

Continental Industrial Engineers, Inc., (D). Industrial gas exhibit. Heat-treating furnaces.

Copperweld Steel Co., (F-20). "Aristoloy" steels, including aircraft quality steels.

Cowles Detergent Co., (Z-109). Metal-cleaning materials.

Crescent Machine Co., (Z-234). Metal-cutting bandsaws and woodworking machinery.

Crown Rheostat & Supply Co., (X-8). Polishing and plating equipment.

Crucible Furnace Co., (Z-223). Melting furnaces.
Crucible Steel Co. of America., (Y-). Crucible and tool steels.

Cyclone Fence Co., (Z-104). See United States Steel Corp.

De Sanno & Son, A. P., Inc., (H-32). Abrasive cutting and grinding equipment.

Despatch Oven Co., Industrial Gas Exhibit. Gas heat-treating furnaces.

Detroit Rex Products Co., (Y-9). Degreasing and cleaning machines and compounds.

Detroit Testing Machine Co., (X-1). Hardness and other testing machines.

Diamond Iron Works, Inc., (G-15). See Mahr Mfg. Co.

Dietert Co., Harry W., (G-24). Spectrographic and other analytical equipment.

Dow Chemical Co., (Y-58). Magnesium alloy castings, extruded shapes, sheet and plate.

Drever Co., (Y-13). Chapmanizing process for carbon steels and Drever process for stainless.

Driver-Harris Co., (A-28). Heat and corrosion resisting alloys.

Du Pont De Nemours & Co., E. I., (D-7). Plating chemicals, acids, pickling inhibitors, heat-treating salts and metal cleaners.

Duraloy Co., (G-19). Heat and corrosion resistant castings.

Eastern Cutter Salvage Corp., (Z-139). Tool salvage.

Ecco High Frequency Corp., (Y-24). High frequency converter equipment.

Eclipse Fuel Engineering Co., (N). Industrial Gas Exhibit. Heat-treating furnaces.

Eisler Engineering Co., (D-29). Electric spot and butt welders.

Electric Controller & Mfg. Co., (B-29). Welding contactors and indicating lights.

Electric Furnace Co., (F-21). Electric, oil and gas-fired heat-treating furnaces.

Electro Alloys Co., (G-2). Heat and corrosion resisting alloys.

Electro Manganese Corp., (Y-15). Electrolytic manganese.

Electro Metallurgical Co., (D-14). Alloy and corrosion resisting steels and irons, ferro-alloys.

Electroloy Co., (B-32).

Expert Welder Co., (B-32).

Federal Machine & Welder Co., (D-34). Electric spot, projection, butt and seam welders.

Federal Products Corp., (G-36). Precision measuring instruments.

Fieser & Lundt, Inc., (J). Industrial Gas Exhibit. Gas burners, compressors and blowers.

Firth-Sterling Steel Co., (X-11). Carbide tools, stainless steel products, wear resisting parts.

Foote Bros. Gear and Machine Co., (H-3). Special alloy steels, gears, speed reducers, precision parts.

Forest City Foundries Co., (Y-4). Gray iron, semi-steel and alloy semi-steel castings.

Foxboro Co., (F-14). Automatic temperature control instruments.

Fulton Foundry & Machine Co., (G-5). Castings.

Gas Machinery Co., (DD). Industrial gas exhibit. Rotary forge furnace, gas burners.

General Alloys Co., (Z-201). Heat and corrosion resistant alloys, furnace parts.

General Electric Co., (A-11). Electric furnaces, atmospheric controls, welding machines.

General Electric X-Ray Corp., (A-11). X-ray testing equipment, diffraction units.

Globar Div., Carborundum Co., (E-32). Electric heating elements.

Globe Machine & Stamping Co., (Z-234). Sheet metal stampings, dies.

Gogan Machine Co., (F-25). Brinell testers.

Gordon Co., Claud S., (X-1). Heat-treating furnaces and supplies and hardness testing equipment.

H & H Research Co., (Z-134). Portable electric tools.

Halcomb Steel Co., (Y-6). Tool and alloy steels.

Hamilton Mfg. Co., (G-31). Drafting room furniture.

Hammond Machinery Builders, Inc., (Z-111). Grinding and polishing equipment.

Harnischfeger Corp., (E-20). Electric welding equipment, electrodes, hoists and motors.

Harris Calorific Co., (Z-202). Welding and cutting equipment.

VISIT AMERICAN MACHINIST, BOOTH Z-232, AT THE METAL SHOW

Hauck Mfg. Co., (I-32). Oil and gas burners, regulating valves.

Hayes, Inc., C. I., (D-21). Heat-treating furnaces.

Haynes Stellite Co., (D-14). Abrasion and corrosion resisting tools and alloys, hard facings.

Heltzel Steel Form & Iron Co., (E-1). Welded steel forms and plate work.

Hevi Duty Electric Co., (D-27). Electric heat-treating furnaces.

Hobart Bros. Co., (C-28). Arc welding equipment.

Holliday & Co., W. J., (Z-122). Speed case and speed treat steels.

Hollup Corp., (G-42). Arc welding equipment.

Holo-Krome Screw Corp., (Y-19). Socket screws.

Hones, Inc., Charles A., (H). Industrial Gas Exhibit. Pot and oven furnaces, burners.

Hoskins Mfg. Co., (Y-43). Heat-resisting castings, resistor alloys.

Houghton & Co., E. F., (B-4). Carburizing compounds, heat-treating salts, lubricants, cutting oils, leather belting and packings.

Illinois Testing Laboratories, Inc., (I-12). Pyrometers, thermometers and controllers.

Illinois Tool Works, (B-14). Measuring machines, recording systems, gear testing equipment.

Independent Pneumatic Tool Co., (F-12). Portable Electric and pneumatic tools.

Industrial Steels, Inc., (Y-13). Chapmanizing process for carbon steels, Drever process for stainless.

Ingersoll Steel & Disc. Div., Borg Warner Corp., (C-9). Alloy, stainless clad and tool steel.

International Nickel Co., Inc., (B-8). Nickel and nickel alloys.

Jackson Buff Co., (Y-21). Buffing wheels.

Johns-Manville Corp., (A-27). Insulating and refractory materials.

Jones & Laughlin Steel Corp., (C-32). Hot and cold rolled steel.

Kelley Co., J. W., (F-29). Industrial oils, heat-treating products.

Kemp Mfg. Co., C. M., (G). Industrial Gas Exhibit. Gas producers and pre-mixers, dehydrators.

King, Andrew, (A-30). Consulting engineer.

Krouse Testing Machine Co., (Y-41). Repeated stress testing machines.

Lake City Malleable Co., (Z-138). Malleable iron.

Lakeside Steel Improvement Co., (E-8). Heat-treating equipment and products.

LaSalle Steel Co., (C-18). Cold finished steel bars, stressproof steels.

Leeds & Northrup Co., (G-22). Heat-treating furnaces, pyrometers and control instruments.

Lepel High Frequency Laboratories, (Z-224). High frequency converters.

Lester Engineering Co., (Z-228). Die casting machinery.

Lewies Machine Co., (A-31). Wire straightening and cutting machinery.

L'Hommedieu & Sons Co., Chas. F., (C-23). Plating and polishing supplies.

Lincoln Electric Co., (B-10). Electric welding equipment and supplies.

Lindberg Engineering Co., (X-3). Heat-treating furnaces and equipment.

Linde Air Products Co., (D-14). Gas welding and cutting apparatus.

Machinery Mfg. Co., (F-9). Machine tools.

Macklin Co., (X-9). Grinders and wheels.

Magnaflux Corp., (C-22). Magnetic inspection.

Magnetic Analysis Corp., (E-2). Magnetic inspection equipment.

Mahr Mfg. Co., (G-15). Oil and gas furnaces and burners.

Mallory & Co., Inc., P. R., (B-32 and Z-119). Welding electrodes, non-ferrous alloys, bi-metals.

Manganese Steel Forge Co., (H-12). Manganese steel rolled, pressed and forged products.

Manhattan Rubber Mfg. Co., (D-28). Abrasive cut-off and finishing wheels.

Marburg Bros., Inc., (C-19). Jigs and special tools, toolroom machines.

Martindale Electric Co., (Y-50). Flexible shaft units, protective masks.

Master Chrome Service, Inc., (Z-139). Hard chrome plating.

Master Tool Co., Inc., (Z-139). Tool salvage.

Matchless Metal Polishing Co., (Y-16). Polishing compounds.

Maurath, Inc., (Z-102). Welding electrodes.

McKay Co., (F-24). Welding electrodes, chain.

Metal & Thermit Corp., (D-3). Welding electrodes and equipment, high purity metals.

Metals Disintegrating Co., (Y-30). Metal powders.

Metlab Co., (Y-10). Heat-treatment of metals.

Michiana Products Corp., (H-25). Corrosion and abrasion resistant alloy castings.

Mine Safety Appliances Co., (E-5). Industrial safety equipment.

Minneapolis-Honeywell Regulator Co., (F-14). Instruments and controllers.

Molybdenum Corp. of America, (A-1A). Molybdenum and tungsten alloys, ferro-alloys, metal powders.

Moore Special Tool Co., (C-19). See Marburg Bros.

Morrison Engineering Co., (I-34). Heat-treating equipment.

Multi-Hydromatic Welding & Mfg. Co., (B-32). Automatic welding equipment.

National Carbide Corp., (G-20). Calcium carbide.

National Carbon Co., (D-14). Acheson graphite electrodes for arc-type electric furnaces.

National Copper Paint Corp., (E-6). Surface protection compounds for heat-treatment.

National Cylinder Gas Co., (G-40, G-42 and H-40). Oxy-acetylene cutting machines, flame-hardening.

National Electric Welding Machine Co., (C-30). Electric welding equipment.

National Lead Co., (I-42). Lead alloys.

National Machine Works, (P). Industrial Gas Exhibit. Industrial gas apparatus.

National Tube Co., (Z-104). Seamless and welded tubular products.

New Jersey Zinc Co., (D-8). Zinc die castings.

Nicholson File Co., (F-38). Files.

North American Mfg. Co., (F and G-28). Burners, atmosphere control devices, turbo-blowers.

Norton Co., (A-9). Abrasive products, grinding wheels.

Oakite Products, Inc., (Y-35). Metal cleaning materials and equipment.

Ohio Carbon Co., (B-2). Carbon brushes, contacts.

Ohio Crankshaft Co., (A-2). Tocco induction hardening equipment.

Ohio Seamless Tube Co., (A-29). Seamless tubing, electric welded sections.

Olsen Testing Machine Co., Tinius, (C-15). Testing machines.

Osborn Mfg. Co., (G-32). Foundry molding machinery.

Otis Steel Co., (Z-126). Steel plate, sheet, strip and castings.

Owens-Corning Fiberglas Corp., (Y-34). Motor insulation.

Packer Machine Co., (Y-21). Polishing and buffing machines.

Page Steel & Wire Div., American Chain & Cable Co., (G-4). Welding wire and electrodes.

Pangborn Corp., (F-22). Rotoblast cleaning and duct-collecting equipment.

Park Chemical Co., (C-7). Heat-treating, buffing and polishing materials.

Parker-Kalon Corp., (G-37). Screws and fastening devices.

Partlow Corp., (A). Industrial Gas Exhibit. Temperature control units.

Phillips Mfg. Co., (X-23). Metal cleaning machines.

Phoenix Machine Co., (Z-228). Die casting machinery.

Physicists Research Co., (I-4). Profilometer and accessories for measuring surface roughness.

Pittsburgh Crucible Steel Co., (Y-6). Alloy steel.

Progressive Welder Co., (D-30). Welding machines, punching units, riveting units.

Pyrometer Instrument Co., (F-23). Pyrometers and radiation tubes.

Radium Chemical Co., (F-39). Radiographic equipment, radium.

Ransohoff, Inc., N., (Y-38). Metal cleaning.

Ransome Concrete Machinery Co., (E-12). Revolving welding tables.

Reeves Pulley Co., (Y-62). Variable speed control equipment.

Republic Steel Corp., (A-10). Alloy and stainless steels, strip steel, wire products, tin plate.

Revere Copper & Brass Co., (X-19). Copper, brass and bronze products.

Riehle Testing Machine Div, American Machine & Metals, Inc., (Y-22). Universal testing machines, hardness testers.

Roebling's Sons Co., John A., (F-2). Wire rope, shaped wire, insulated wires and cables.

Ruemelin Mfg. Co., (F-7A). Fume collectors, blast cleaning machines.

Rustless Iron & Steel Corp., (Y-31). Stainless steels and irons.

Safety Socket Screw Corp., (F-33). Socket screw products.

Salem Engineering Co., (X-5). Industrial furnaces.

Sciaky Corp., (A-34). Electric resistance spot welding equipment.

Scully Steel Products Co., (Z-104). Carbon and alloy steel flats, rounds, bars, rods, wire and shapes.

Selas Co., (B). Industrial Gas Exhibit. Gas burners, furnaces, controllers.

Sellers Engineering Co., (O). Industrial gas equipment.

Sentry Co., (G-25). Hardening furnaces, high temperature tube furnaces.

Shakeproof Lock Washer Co., (B-14). Fastenings.

Sleeper & Hartley, Inc., (B-31). Wire and spring machinery.

S-M-S Corp. (B-32). Welding electrodes, alloys.

Spencer Turbine Co., (H-23). Turbo compressors, gas boosters and vacuum cleaners.

Sperry Products Co., (Y-10). Electric flaw detector.

Standard Alloy Co., (I-31). Heat and corrosion resistant alloys.

Standard Machinery Co., (Z-220). Presses, drop hammers, rolling mills, swaging machines, wire drawing machinery, and special tools.

Standard Oil Co., (Z-206). Petroleum products.

Standard Steel Spring Co., (X-7 and X-17). Corrosion-proof coatings.

Stanley Electric Tool Division, (F-7). Electric tools.

Sterling Grinding Wheel Co., (Z-131). Grinding wheels.

Stoody Co., (D-32). Hard facing alloys.

Stuart & Co., D. A., (A-23). Industrial oils and greases, cutting and grinding compounds.

Surface Combustion Corp., (C). Industrial Gas Exhibit. Heat-treating furnaces and accessories.

Swift Electric Welder Co., (B-32). Butt, spot and projection welders.

Tagliabue Mfg. Co., C. J., (A-19). Pyrometers, thermometers, controllers and other instruments.

Taylor-Hall Welding Corp., (B-37). Spot welders.

Taylor-Winfield Corp., (B-36). Electric butt, spot and steam welders.

Tennessee Coal, Iron & Railroad Co., (Z-104). High tensile and stainless steels.

Thom McAn Safety Shoes, Melville Shoe Corp., (I-36). Safety shoes.

Thompson & Son Co., Henry G., (F-5). Metal-cutting bandsaws.

Thomson-Gibb Electric Welding Co., (B-32). Resistance welding machines.

Tide Water Associated Oil Co., (H-42). Industrial oils and greases, soluble cutting oils.

Timken Roller Bearing Co., (D-6). Alloy, stainless, tool and die steels.

Tinnerman Products, Inc., (A-3). Fastening devices.

Titanium Alloy Mfg., (F-13). Titanium, ferro-alloys, refractories.

Towmotor Co., (E-36). Industrial trucks, tractors.

Una Welding, Inc., (X-15). Welding machines and supplies.

Union Carbide & Carbon Corp., (D-14). Welding and cutting equipment, ferro-alloys, heat and corrosion resisting alloys.

United States Steel Corp., (Z-104). Alloy steels, high tensile steels, stainless steels.

Universal Cyclops Steel Corp., (Z-123). Stainless, tool and high grade specialty steels.

Vanadium Alloys Steel Co., (D-23). Tool steels.

Vanadium Corp. of America, (Y-2). Ferro-alloys, vanadium steels and irons.

Victor Saw Works, Inc. (F-10). Hacksaw machines and blades.

Wall Colmonoy Corp., (Y-39). Hard facing alloys.

Welding Engineering Co., (I-4A). Electrode holders.

Welding Machines Mfg. Co., (C-33). Resistance welding machines.

Welding Sales & Engineering Co., (B-32). Automatic welding machines, electric arc welders.

Wells Mfg. Corp., (G-27). Metal bandsaws.

Westinghouse Electric & Mfg. Co., (B-22). Electric controlled-atmosphere furnaces, welding equipment, high strength and brazing alloys.

Wheelco Instrument Co., (F-19). Pyrometers, thermometers, control equipment.

Whistler & Sons, Inc., S. B., (Z-246). Piercing dies.

Williams & Co., (H-33). Tubing, welding supplies, non-ferrous alloys.

Willson Products, Inc., (Z-236). Personal protective products.

Wilson Mechanical Instrument Co., (C-10). Rockwell hardness testers.

Wilson Welder & Metals Co., (G-20). Welding equipment.

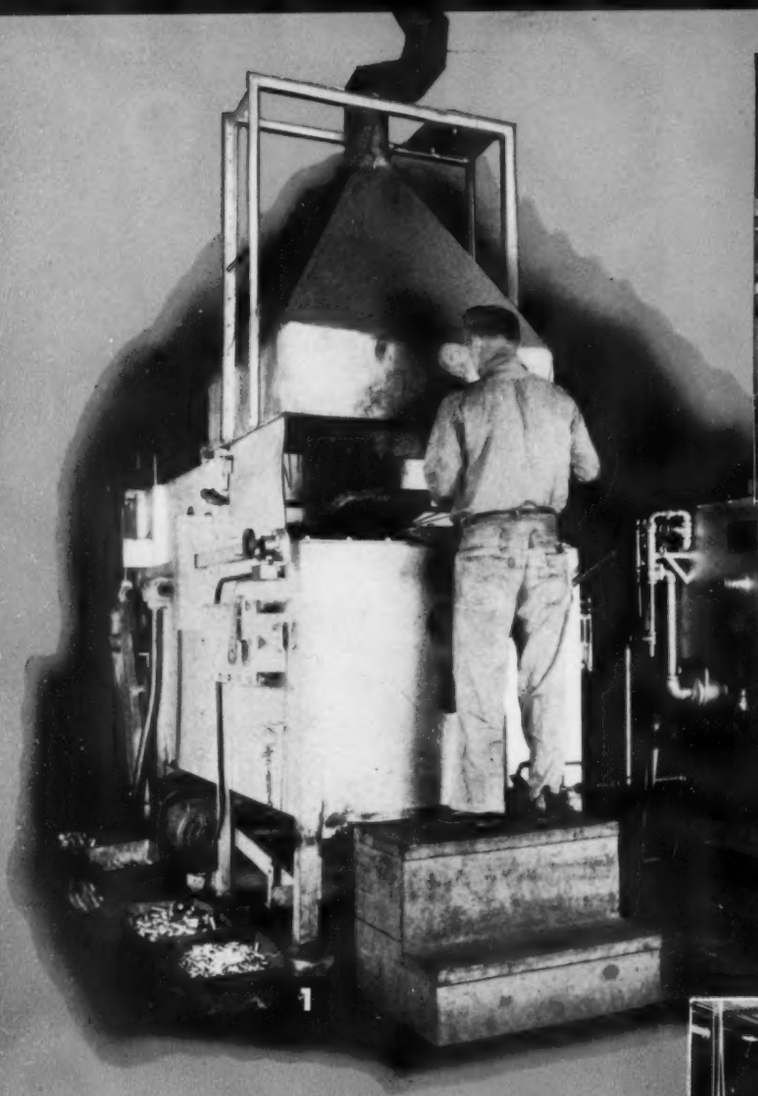
Youngstown Sheet & Tube Co., (F-18). Alloy and high tensile steels.

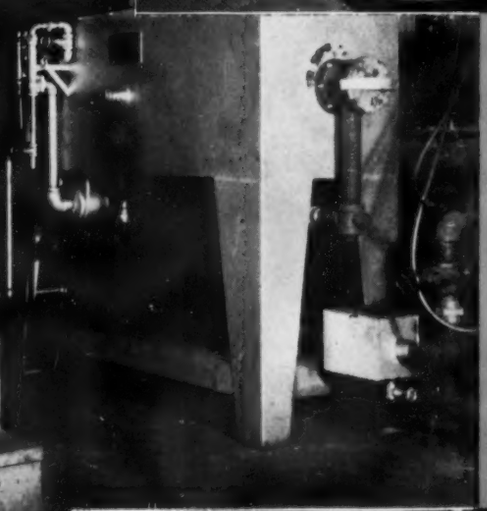
Armament

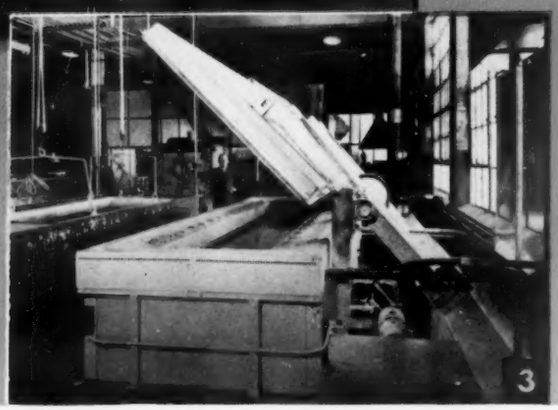
SECTION OF AMERICAN MACHINIST

HEAT-TREATING FOR DEFENSE

WELDING FOR DEFENSE





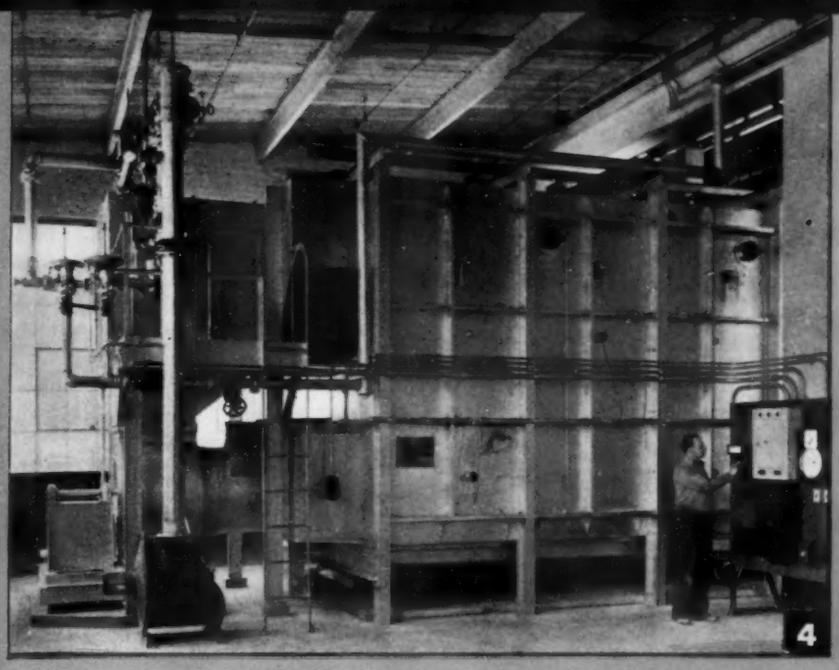


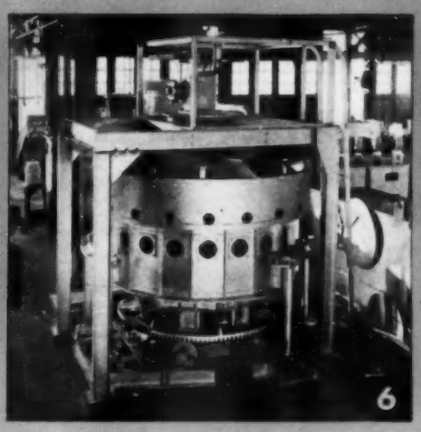
HEAT-TREATING FOR DEFENSE

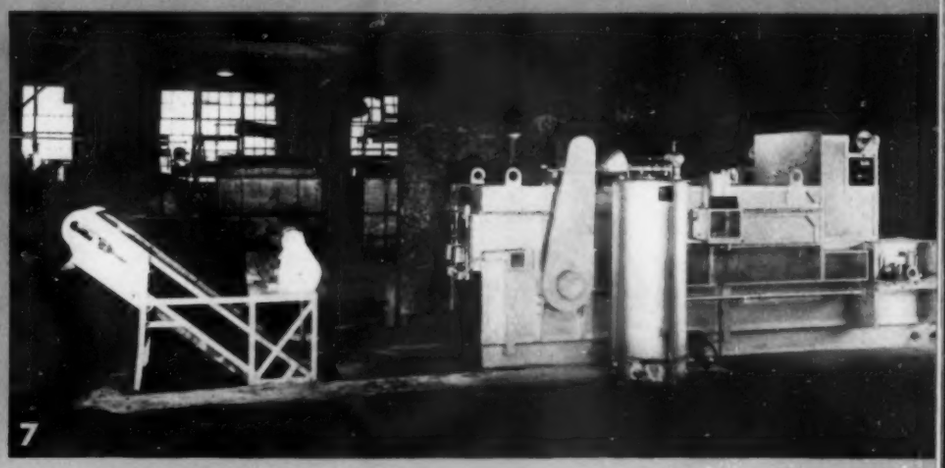
1. This electric furnace is equipped with "Endogas" generating equipment developed for short-cycle heat-treating carbon steels in a balanced protective atmosphere. The set-up involves pre-adjusting the composition of the furnace atmospheres to equilibrium with the carbon in the steel being heat-treated. The gas generating equipment can be applied to practically all types of furnaces and uses ordinary natural or manufactured fuel gases with satisfactory results. Furnaces equipped with such generating units are suitable for scale-free "bright" hardening of a wide range of parts, and are applicable for the heat-treatment of armor-piercing shells for anti-type and anti-aircraft guns, for parts used in tanks and other ordnance assemblies, and for aircraft engine parts.

2. These pots, filled with engine cylinder liners, have just been removed from the carburizing furnace shown at the left, and are being lowered into a gas atmosphere cooler. The liners come out of the furnace at 1700 F. and must be left in the pots in the cooler for 3½ hr. before they can be handled.

3. Several hundred electrically-heated salt baths have been installed by American industry duirng the past few years. These installations range in size from small pot-type baths for heat-treating rivets to large production baths 20 to 30 ft. long for heat-treating aluminum-alloy aircraft assemblies. This unit, recently installed in Buffalo for the Curtiss Aeroplane Div. of Curtiss-Wright Corporation, has inside dimensions of 3 ft. wide, 4½ ft. deep and 15 ft. long. It is heated by 24 immersion-type units placed directly in the molten salt. Maximum operating temperature is 1000 F. The two-piece motor-operated cover is shown in the half-raised position. Operation of the cover is remote-controlled from a conveniently located pushbutton station.





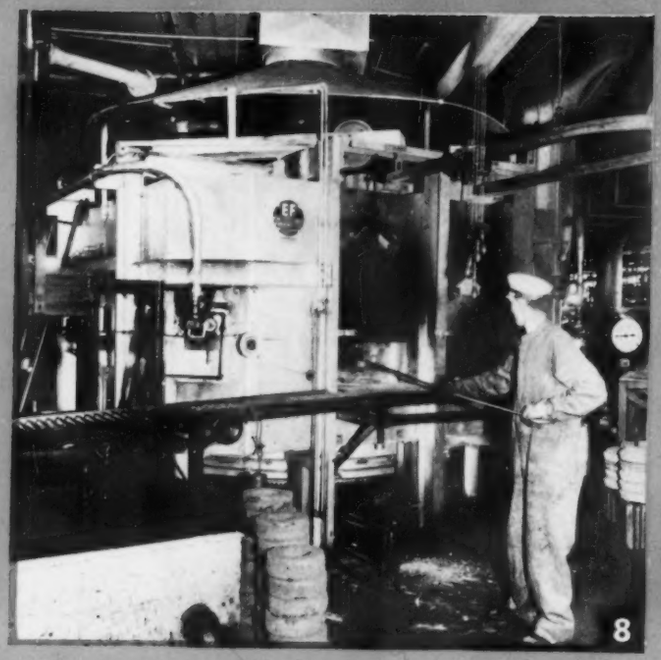


4. This car bottom type recirculated air furnace is used by York Safe & Lock Company for stress-relieving welded gun mounts and other structures. The car for this furnace has a capacity for a load of 10,000 lb., and the furnace will heat 5,000 lb. of steel per hour to 1120 F. As previously described (*AM*—Vol. 83, page 405), the complete cycle for a load in this furnace averages 20-24 hr. A bank of recording pyrometers with thermocouples at sixteen positions check the furnace temperature during the entire annealing cycle. These pyrometers, together with other control instruments, are mounted on a panel board adjacent to the furnace.

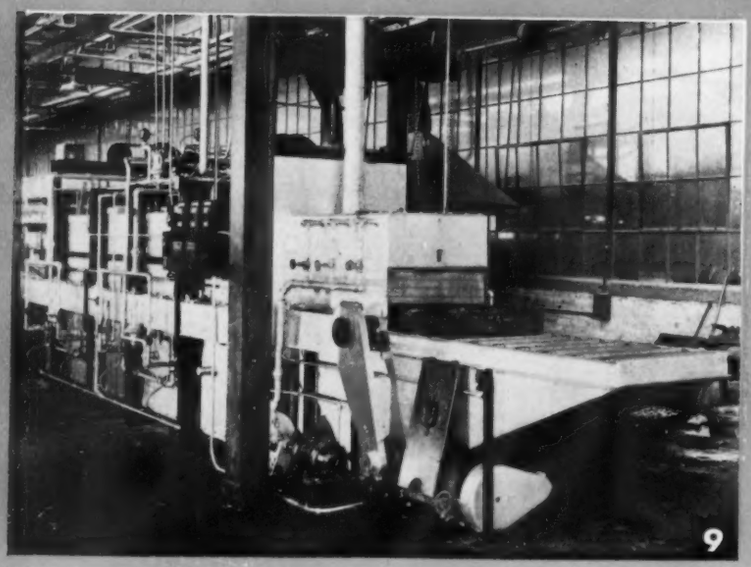
5. Many of the gears used in aircraft engines are quenched in Gleason presses to prevent distortion. The segment shown goes into the press at 1380 F., having just been taken out of an adjacent furnace.

6. Developed especially for heating 155 mm. shells prior to nosing, this rotary furnace has capacity of 2,250 lb. per hr. when heating 9 in. of shell length to 1900 F. This corresponds to a capacity of 50 shells per hour. An interesting feature of this particular installation is that means are incorporated in the furnace to rotate the shells during the heating operation. Chief advantage of the rotary-type furnace is that it requires only one operator for loading and unloading, in many cases the same operator can perform the nosing operation.

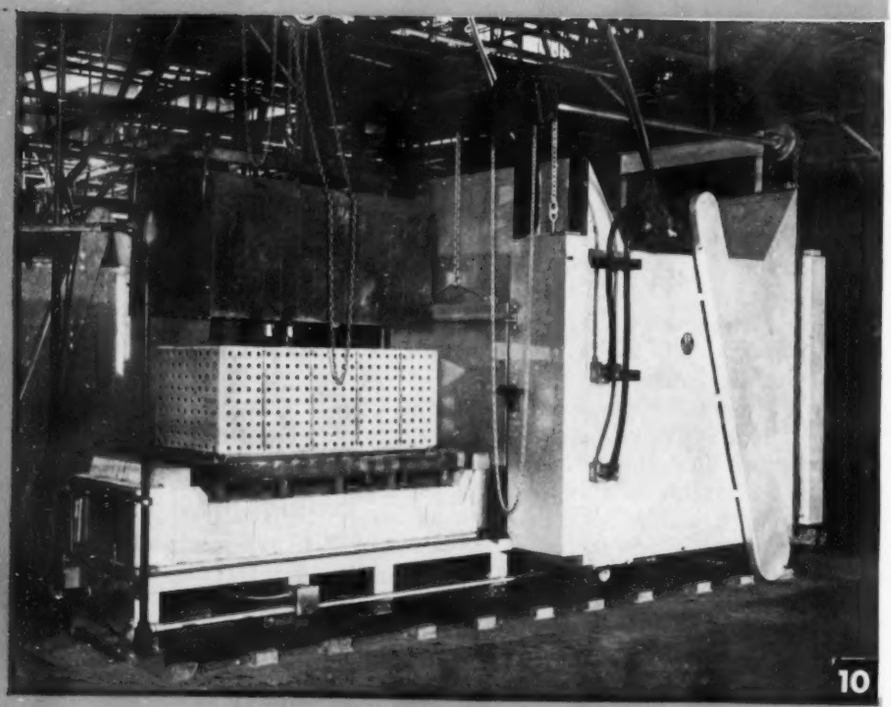
7. Steel belt links for 30 and 50 calibre cartridges must have sufficient spring to enable the gun to pull the cartridge out without jamming and yet must be strong enough to convey the shell into the gun. This makes the heat-treatment of the links very important. Conveyor-type, electrically heated hardening furnaces of the type shown are especially suited for this operation. This furnace provides "Hydrizing" atmosphere for scale-free hardening.



8. Large aircraft engine forgings and miscellaneous other parts in various sizes and shapes are heated in oil-fired rotary hearth furnaces. This particular furnace is heated by means of oil-air proportioning type burners which are divided into two separately and automatically controlled zones. It is designed for operating at and maintaining any desired temperature from 1100 to 1800 F., and has capacity for heating 1000 lb. of material per hour to 1800 F. The rotary-hearth furnace is especially adapted for the heating of blanks from which steel shell are to be forged.



9. Especially suited for annealing brass, copper and nickel-silver drawn shells and stampings at temperatures from 600 to 1400 F., this gas-fired continuous roller hearth furnace has a spray quenching unit for cooling the material before it comes into contact with the air after the discharge from the furnace. The material to be annealed is loaded into light, skeleton-type heat-resisting alloy baskets or trays which automatically are conveyed through the furnace on driven rolls. Baskets are 30 in. long and 26 in. wide, hold 1100 lb. of material, in the set-up shown.



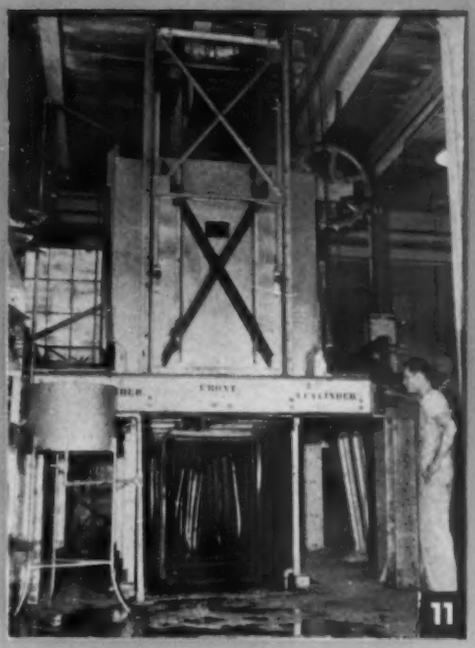
10. Extremely hard, abrasion, corrosion and wear resisting surfaces are produced on aircraft engine and other parts, without quenching, by heating them in contact with ammonia gas in semi-continuous nitriding furnaces of the type shown. This particular equipment consists of a movable furnace chamber mounted on track wheels and located above a structural hearth on which two or more nitriding retorts are placed. This view shows the top removed from one of the nitriding containers and shows the inner construction of the basket for holding the charge.

11. This special heat-treating furnace was designed by Northrop Aircraft engineers for heating and quenching formed aluminum parts. The parts are suspended in a special rack, as shown, and then drawn up into the furnace for heating. When the heated batch is ready for quenching, a single operation opens the bottom doors of the furnace and lowers the rack of parts into the 5 ft. deep quenching tank set below floor level.

12. Engine mounts of welded steel tube construction are heat-treated in this gas-fired furnace at Consolidated Aircraft Corporation's plant in San Diego, Calif. The furnace is of the car-bottom type, so that the heated mounts can be rolled out of the furnace for air quenching. To prevent warping of the welded frame during cooling, the engine mounts are bolted to a steel table. Hold-down points on the table are heated before the mount is attached.

13. Many of the steel parts used in aircraft assemblies are heat-treated in salt-bath furnaces. This photograph shows the installation for this purpose at Lockheed Aircraft Corporation's plant in Burbank, Calif. Here parts are handled in large trays which are lifted into the furnace pots by overhead cranes.

14. Welded steel gun parts generally are stress-relieved at about 1125 F. in car-bottom type furnaces. Usually about two hours of soaking is allowed for each inch of thickness, and then the parts are allowed to cool to about 400 F. in the furnace. Improved air convection furnaces now are available which have capacities to take such assemblies, and are well fitted for armament work. The tops of these furnaces are removable, which makes it possible to load with a crane and reduces the amount of floor space required by the furnace.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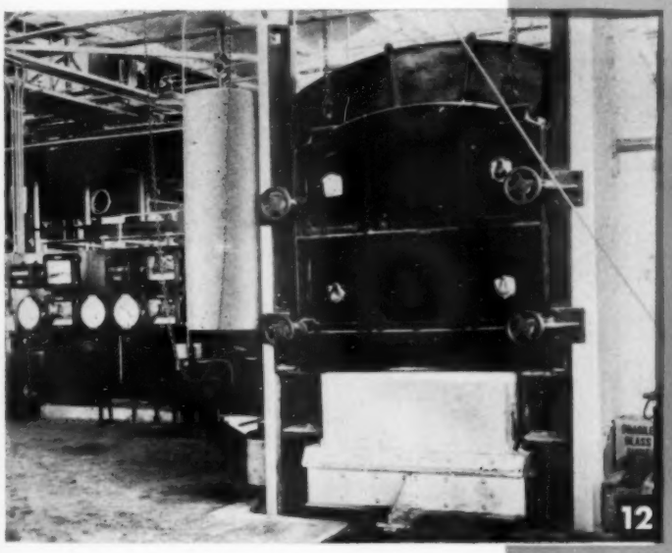
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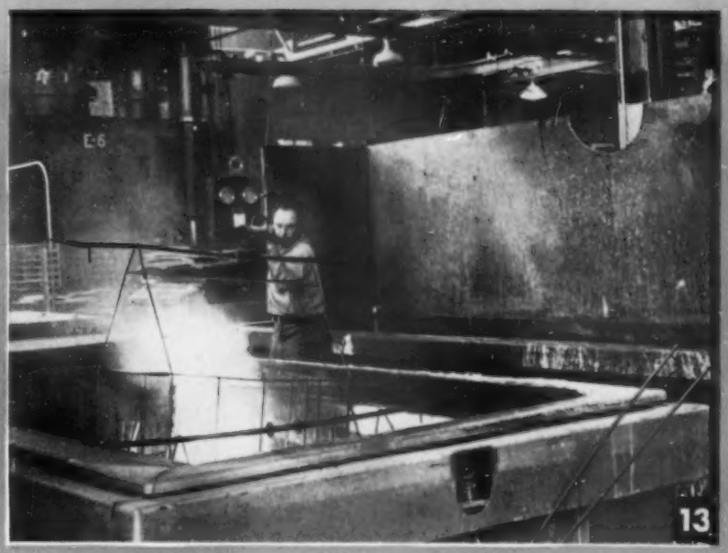
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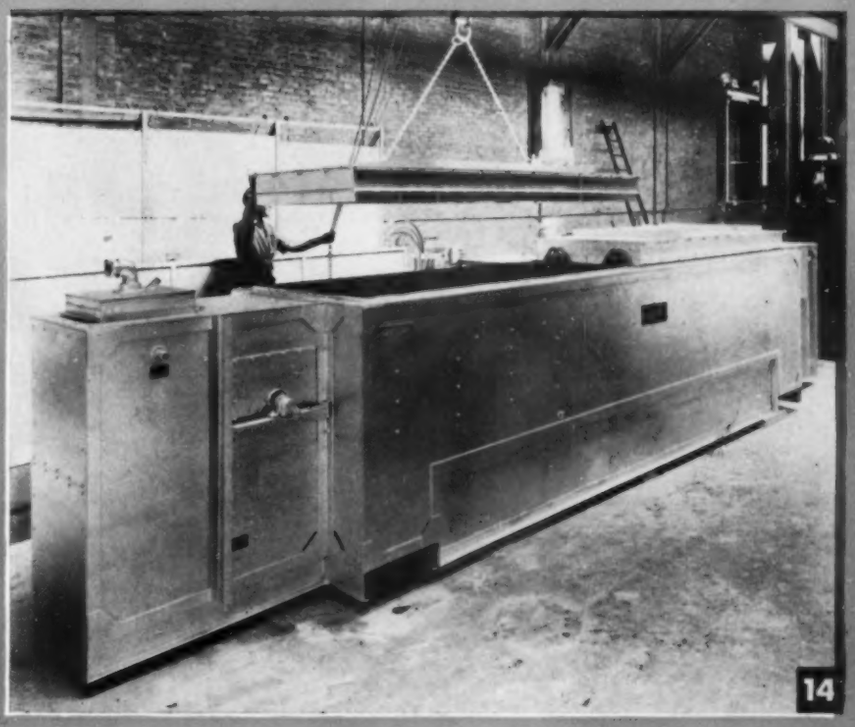
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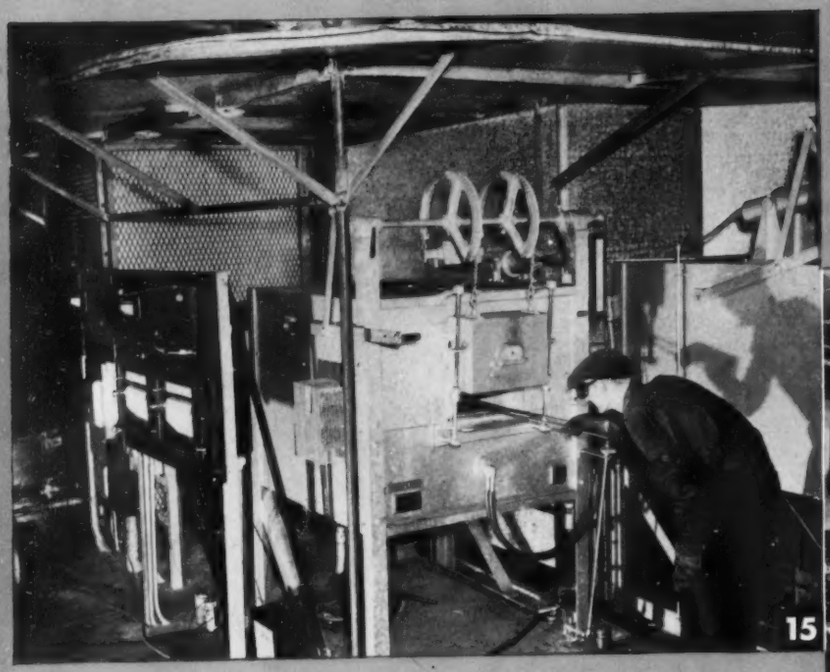
HEAT-TREATING FOR DEFENSE



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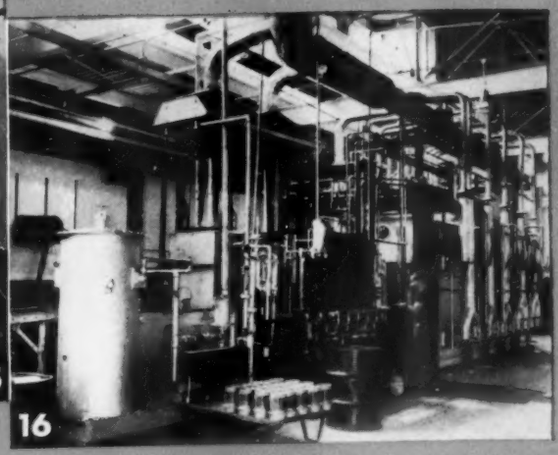

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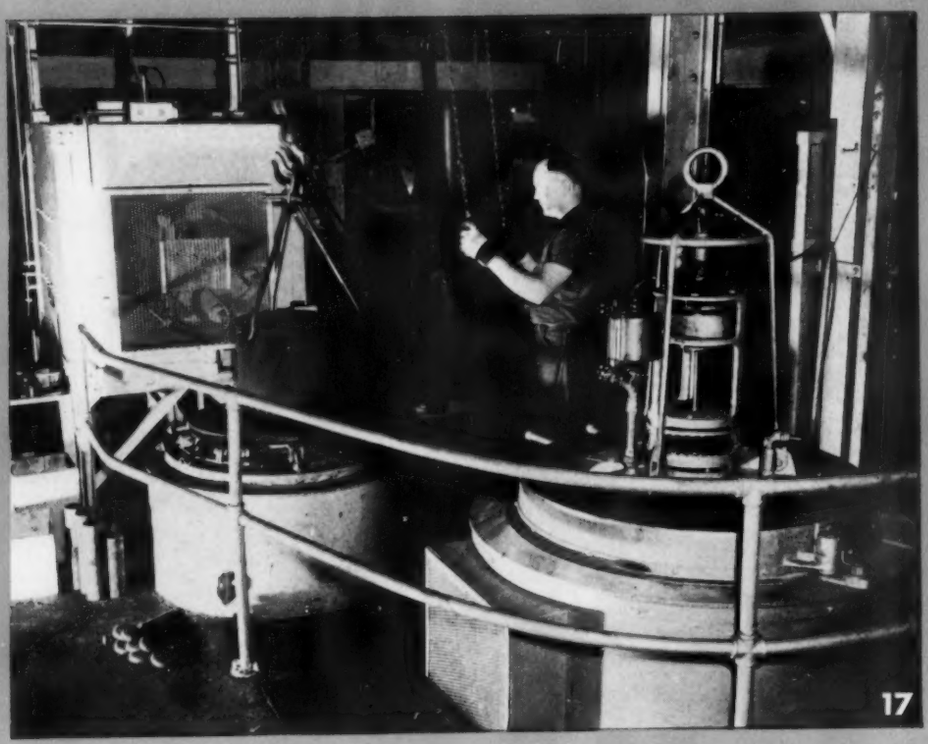

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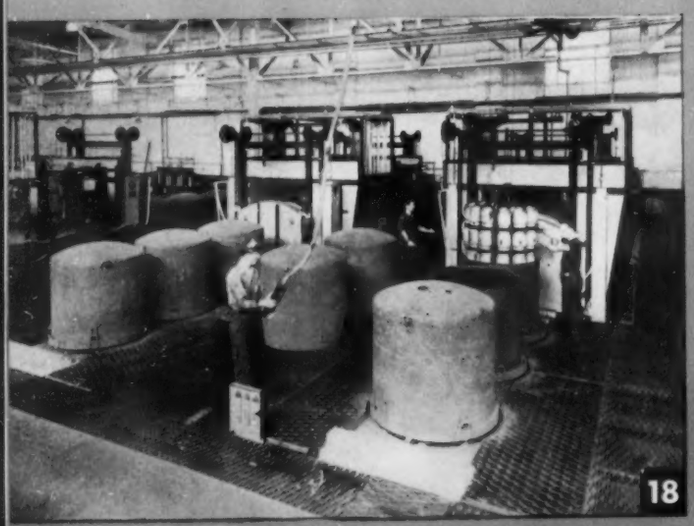

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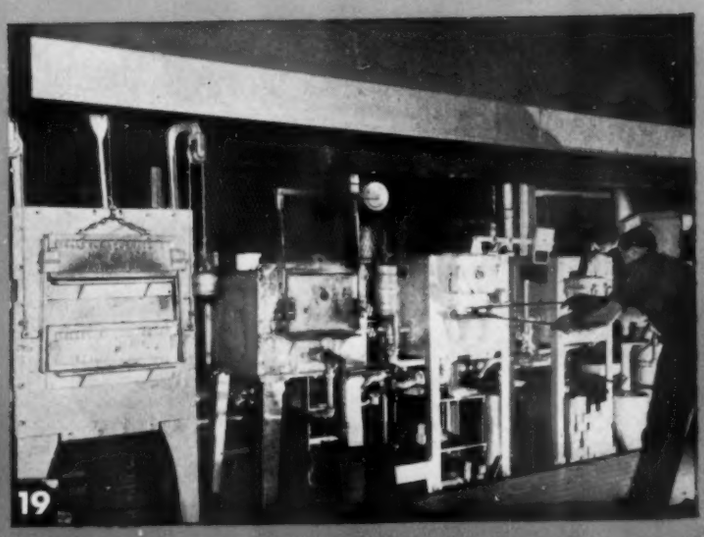

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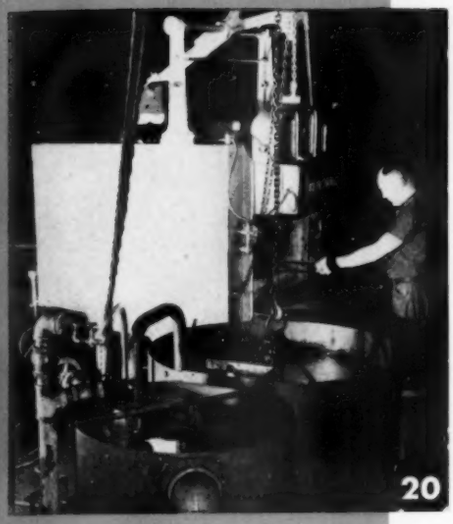
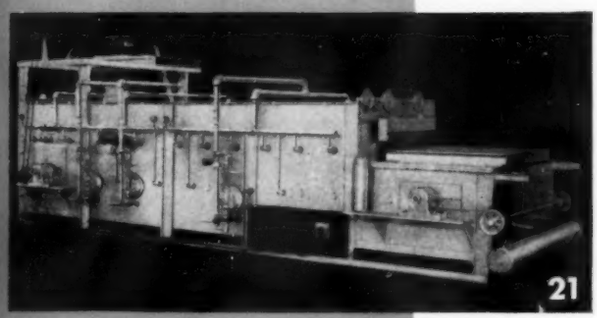
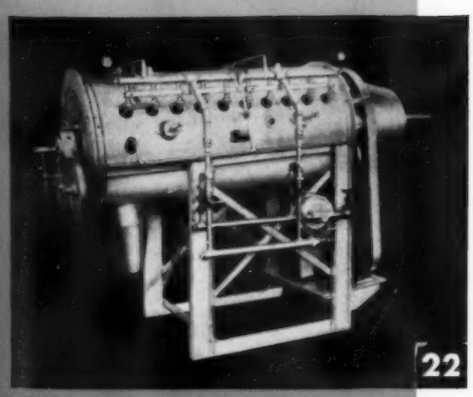


15. This Hayes controlled-atmosphere electric furnace has been installed at the New York Navy Yard for treating high-speed steel cutting tools, hobs, milling cutters and reamers. The unit shown is for preheating and drawing temperatures up to 1850 F. In the right background is a high-heat furnace with Globar heating elements for final heating up to 2400 F.

16. This pusher-type continuous furnace is used by Wright Aeronautical Corporation for hardening a number of parts, including connecting rods and crank shafts. It is a fully automatic gas-fired unit in which individual loads are pushed from one heating zone to the next, while gradually being brought up to the desired maximum temperature. At the discharge end of this furnace, shown in the foreground, is an automatic oil quench and a cleaning unit which consists of an alkali wash and water rinse. After passing through the cleaning unit, individual loads automatically are delivered to one of two conveyor lines, the individual line being selected automatically by means of control keys placed in one corner or the other of the front edge of the load.



17. Hevi Duty electric retort furnaces are used at the New York Navy Yard for carburizing and nitriding wrist pins, plungers, cams, cam rollers and fulcrum pins needed for the diesel engines now under construction for small naval craft and for auxiliary service aboard warships.



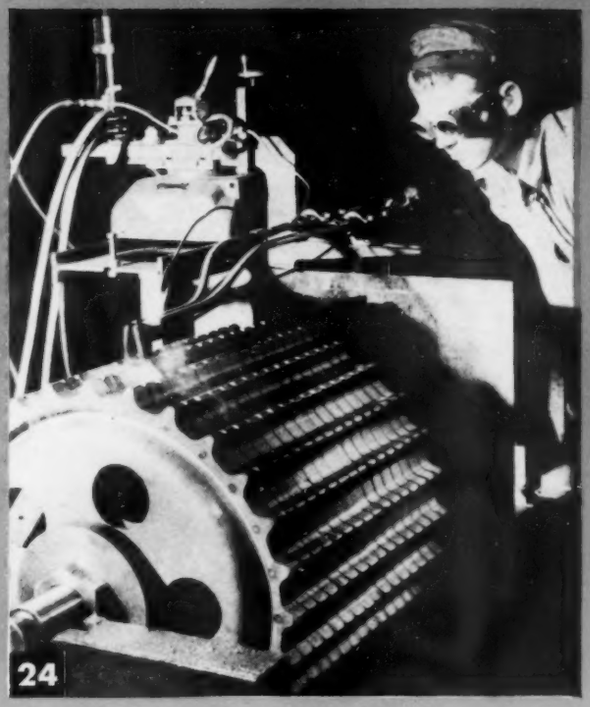
18. Aircraft engine cylinder forgings are nitrided in electric furnaces of novel design recently installed by Wright Aeronautical Corporation. Each furnace is of 150 kw. capacity, and is set into the floor so that the hearth is at floor level, permitting easy handling of the loads when they are lifted by crane into the nitriding pots. Fifty-four cylinder forgings are loaded into each of the three pots at one end of each furnace hearth, then the furnace itself is moved along tracks over that end of the hearth. Each heating cycle includes 10 hr. for bringing the load up to heat, a 35-hr. soak at 1000 F. and a cooling period during which the load is brought down to about 400 F. During this heating and cooling cycle, the three bells at the other end of the hearth are removed, after their loads have cooled to room temperature, and the nitrided cylinder forgings are removed. The bells then are reloaded, ready for the furnace to be moved back into position for heating these three loads. It is of interest to note that the steel grating around these furnaces is removable for easy access to the lower portion of the furnace, permitting easy inspection and maintenance.

19. Gas-fired furnaces, such as these in the tool room at the New York Navy Yard, are used for heat-treating high-speed steel tools. The Bellvue furnace at the left is a combination pre-heating and high-heat unit. Temperatures range up to 2400 F. Recent installations of similar steel-treating furnaces have included some of the electric type.

20. Valve bodies for high-pressure steam, water, air, and oil lines on naval vessels are stress-relieved in electric furnaces similar to this Hevi Duty unit in use at the New York Navy Yard. This furnace also is used for hardening and drawing parts for diesel engines.

21. Designed for normalizing and hardening rifle forgings, this furnace has a heavy cast link conveyor and is arranged with the return loop inside the furnace. When normalizing, the quenching tank is drained and forgings are discharged onto the quenching conveyor for air cooling.

22. Standard rotary gas carburizing machines are used for annealing brass cartridge cases between drawing operations, for applying gun metal finish on rifle and revolver parts, and for hardening a wide range of small parts used in the production of ordnance items. The rotary-retort continuous machine shown is recommended for hardening 0.30 and 0.50 calibre cartridge cores. Automatic hopper feed, automatic conveying and discharge through a port in the retort end side of the machine insures the necessary hardness on every core. Capacity is 300 lb. per hour.



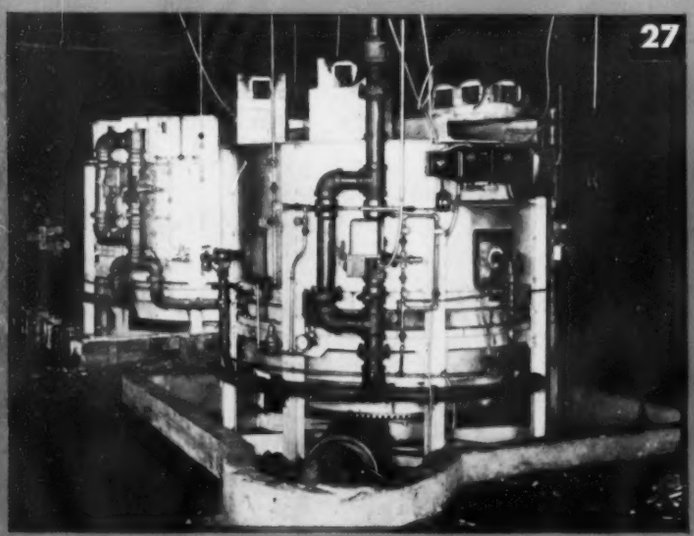
23. Ship piping is made with intricate bends to eliminate fittings and reduce weight. Cold and hot bends set up stresses in tight walls which must be relieved. This Mahr car-bottom type furnace at the New York Navy Yard has eight burners, is 10 ft. wide, 20 ft. long and 15 ft. high, and is suitable for stress-relieving piping. Heat is dissipated through fire brick channels which form part of the support for the charge, thereby keeping the charge out of direct contact with the flame. Temperatures up to 1850 F. are used.

24. By gang-hardening sixteen sprockets at a time, one manufacturer has solved a production problem in the flame-hardening of teeth on rear drive sprockets for a popular line of tractors. Such applications of the flame-hardening process should find much application in the production of parts for tanks, combat cars, and many other ordnance assemblies. The trick in doing this particular operation succesfully was to make sure that the nested parts are clamped tightly together. Hardening is performed with two gear-hardening heads, each attached to an Oxweld blowpipe. The unit is driven by an Oxweld cutting machine. A speed of 7 in. per min. produces a $\frac{1}{8}$ to 3/16 in. depth of case, with the hardness of the flame-treated surface raised to 70 Scleroscope.

25. Homo tempering of magnesium-alloy bracket forgings is done in this furnace by Lycoming Division, Aviation Manufacturing Corporation. Such electrically-heated furnaces can be brought up to full temperature quickly under automatic control.

26. After stress-relieving long and odd-shaped pipe in car-bottom type furnaces, the charge is cooled under sheds which control circulating air current. This shed at the New York Navy Yard is rolled against the furnace and the charge pulled into it. The shed then is moved into the position shown for removing the charge. This method of controlled cooling speeds the stress-relieving cycle.

27. Rotary hearth furnaces long have been used for heating steel blanks for forging. Such furnaces are available with inside diameters ranging



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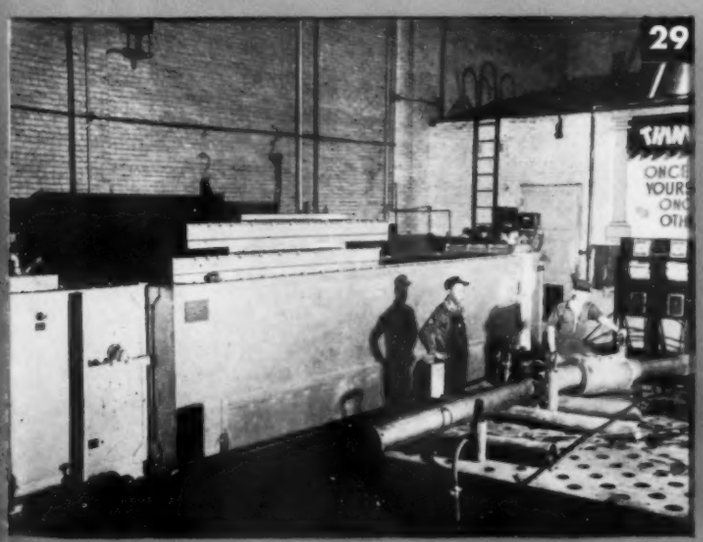
up to about 25 ft., and have been built with rated capacities of up to about 20,000 lb. of steel heated per hour. Such furnaces are particularly suitable for heating blanks from which steel shell are to be formed. In the automotive industry blanks for forgings have been heated at rates as high as 150 lb. per sq. ft. per hr.; at this high rate there is some danger of melting the surface of the steel. While some makers and users of forging furnaces have suggested heating shell blanks at a rate of 60 lb. per sq. ft. per hr., others claim that a rate of 80 to 90 lb. per sq. ft. per hr. should be about right.

28. Builders of aircraft engines and aircraft accesories, such as engine starters, and magnetos, are finding much use for carburizing furnaces in the heat-treating of alloy-steel parts. Semi-machined crankshafts for Wright aircraft engines are stacked on a heat-resistant cast fixture as shown for economic loading in the carburizing furnace.

29. This Lindberg electric furnace recently was installed in the pipe shop of the New York Navy Yard for relieving pipe-wall stresses after bending long sections of large diameter pipe. Such pipe is bent by heating at the radius section, spraying water at the inside of the bend, and pulling the pipe with a winch until it reaches templet form. Furnaces set up adjacent to the bending tables in the pipe shop speed production on this difficult work.

30. Two of the largest recirculated-air type furnaces ever built have been installed by Surface Combustion Corporation at the New York and Philadelphia Navy Yards. They are used for stress-relieving large built-up sections of ship armaments, superstructure, and hull reinforcement. These furnaces have effective internal dimensions measuring 48 ft. wide, 56 ft. long and 29 ft. high. They will heat a charge of approximately 675,000 lb. to 1250 F. in 35 hr., starting with a cold furnace. The structural steel bed for the charge is mounted on rollers to permit necessary expansion and contraction. The furnaces are so large that the only practical way to load and unload them is to remove the roof, which is made portable for this purpose.



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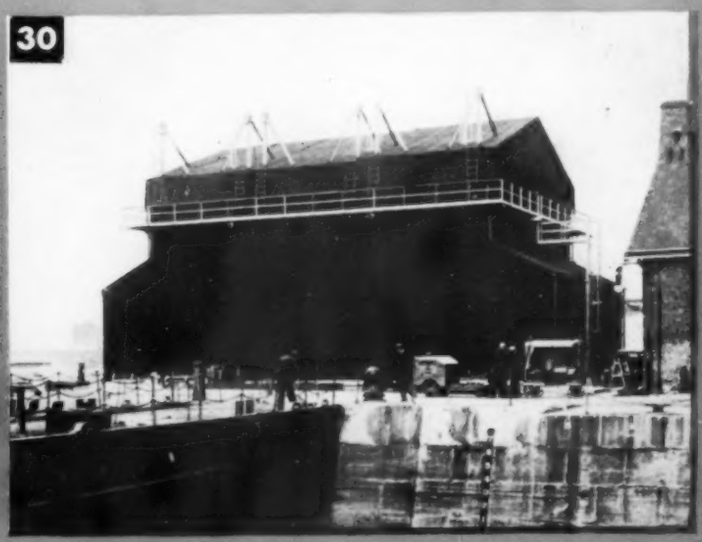

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Arc Welding Aircraft Tubing

Electric arc welding of SAE 4130 and X-4130 steel aircraft tubing has been applied principally to the welding of structural parts, such as fuselages, landing chassis and control surfaces, as well as engine mounts, aircraft boilers, etc. It also found much use in the production of jigs and fixtures used in air-craft production operations. For control surfaces, electric arc welding has been used satisfactorily for metal as thing as 0.031 in. Direct current metallic arc welding is used exclusively. The arc permits compelte weld penetration, and for metal thicknesses up to 3/32 in. the bead will appear on both surfaces of the seam.

The narrower zone affected by the welding heat, and the reduction in contraction and expansion due to the more localized application of heat, are considered advantageous for arc welding. Due to the very thin material used, small electrodes and low currents are required. It now is possible to arc weld down to 5-amp.

With the shielded arc process, using a metallic electrode having a heavy extruded coating, welds may be produced in chrome-molybdenum steel having a tensile strength of 125,000 to 150,000 lb. per sq. in. after heat-treatment. Before proper heat-treatment such welds will develop a tensile strength of 60,000 to 80,000 lb. per sq. in.

Using a carbon arc with a piece of the base metal as filler material, welds can be produced in chrome-molybdenum steel having a tensile strength of 60,000 to 70,000 lb. per sq. in. before heat-treatment. After proper heat-treatment, welds so produced will show a tensile strength of 125,000 to 160,000 lb. per sq. in.

When using a proper shielded arc electrode, with electrode negative and work positive, and with an arc voltage of 23–26, a $\frac{1}{8}$ in. electrode will require 65 to 120 amp., while a 5/32 in. electrode will require 80 to 160 amp.

Heat-treatment to be used after welding with the electric arc is approximately as follows:

1. Normalize to 1650–1750 F. and cool slowly in the furnace below red heat.

2. Heat to 1660–1655 F. and quench in light oil.

3. Draw at about 950 F. to secure desired hardness.

Data from Lincoln Electric Company

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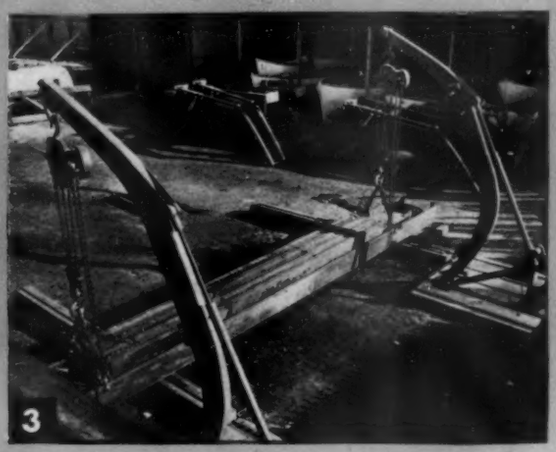
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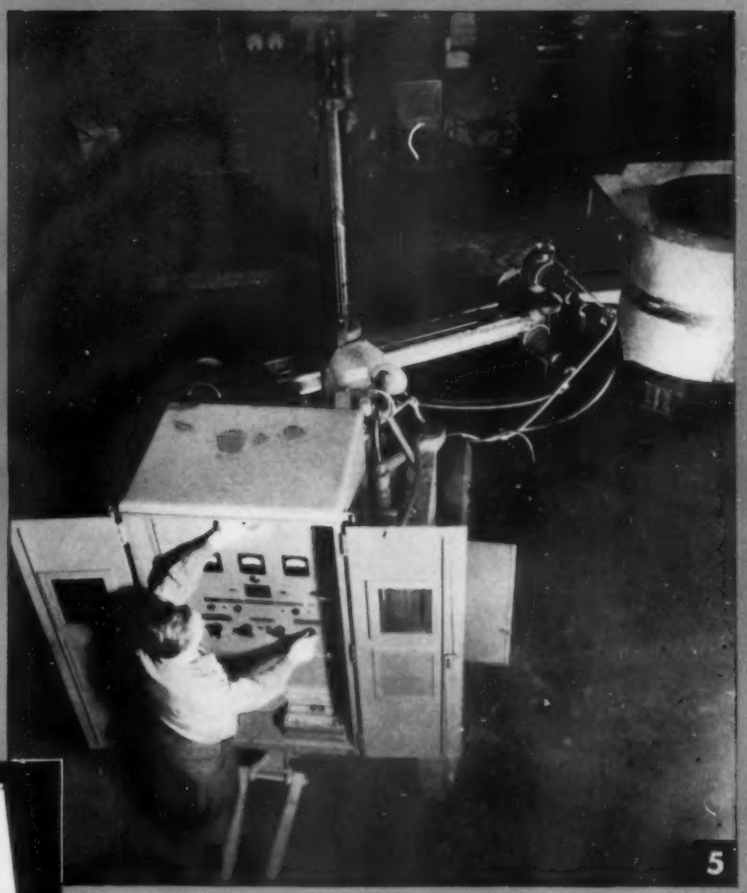


1. With the "Weld-O-Tron" low-current electronic arc welder, which uses currents as low as 5 amp. with 1/32 and 3/64 in. electrodes, steel, stainless steel, Inconel and Monel can be arc welded in thicknesses as small as No. 32 gage. With suitable jigs, this method has been applied to welding exhaust stacks, collector rings and manifolds for airplane engines.

2. Fully automatic welding units are finding considerable use in shipyards to speed assembly of hull and reinforcing members. This "Unionmelt" unit was installed recently in the New York Navy Yard for making butt welds in heavy plate with one pass of the electrode. Simple edge preparation of the plate, little distortion, a weld flush with the plate, and high welding speed are advantages.

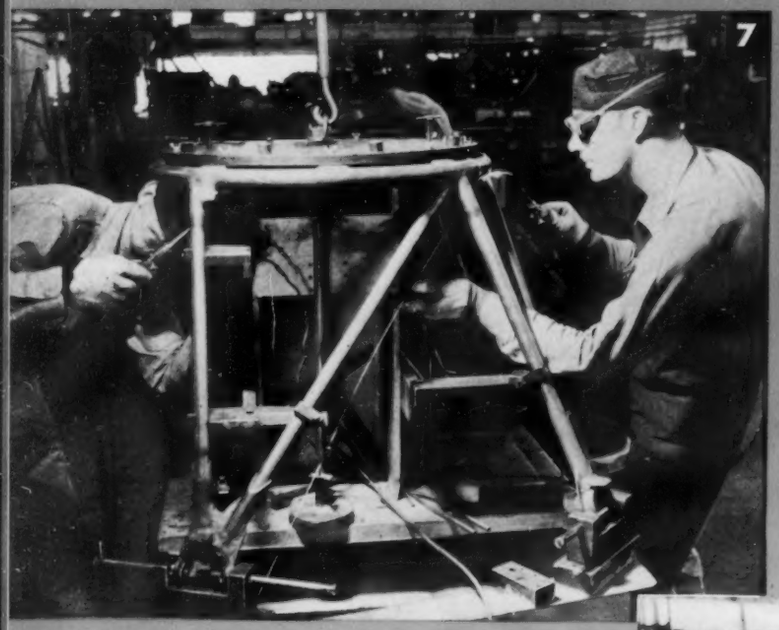
3. Some time ago the Welin Davit & Boat Corporation switched from cast and riveted construction to welding for the manufacture of boat davits, with about 30 per cent saving in fabrication cost. Each set of these davits is tested to carry 100 per cent overload, the set shown is intended to carry a full-loaded 30-ft., 70-person lifeboat.

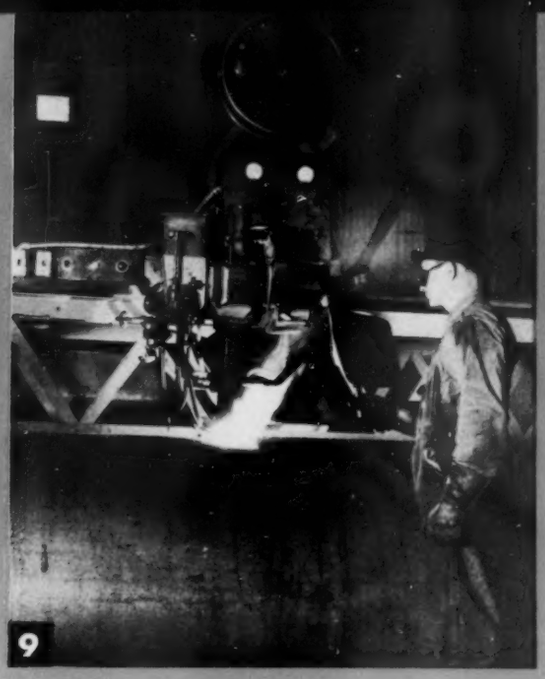
4. Individual welding booths in the structural, sheet-metal and pipe shops at the New York Navy Yard are equipped with portable arc-welding and gas-welding units for fabricating ship structural parts, as for example, this 12-in. gate valve casing. The structural shop has a large welding bay with slotted steel flooring for the assembly of large ship structures, including flooring, bulkheads and machinery foundations.

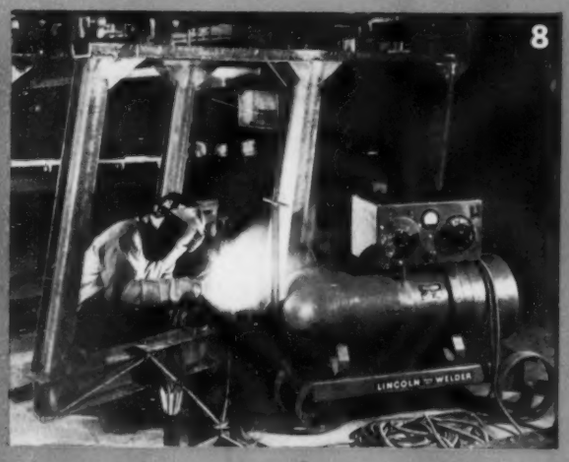
5. Many Army and Navy specifications for welded structures call for radiographic inspection of welds, in some cases this inspection is 100 per cent and in others the welds to be checked with an X-ray unit are selected at random. Both portable and stationary X-ray units are available for this type of inspection, usually they are fitted with universal tube supports which permit inspection of a weld at almost any position on a structure. The 220,000 volt portable X-ray machine shown is mounted on a truck.

6. Radiographs uncover hidden weak spots in welds or castings. Here, a technician is examining two radiographic negatives. The unblemished white line at the top is the X-ray picture of a perfect weld. The black spots in the bottom negative are caused by "slag holes" in the weld.

WELDING FOR DEFENSE







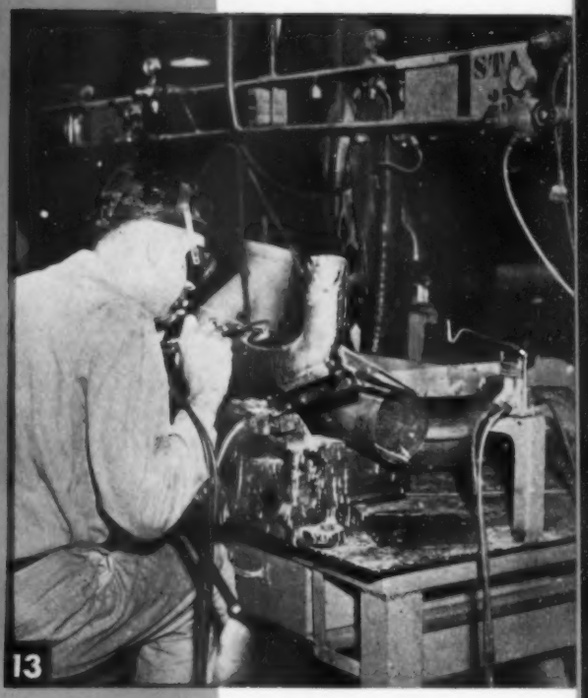
7. Here welders are oxy-acetylene welding the stainless steel tube structure of a Douglas airplane engine mount. Welding jig is of massive construction to provide complete rigidity throughout the welding operation. This jig is rotatable, may be raised or lowered, and is entirely inside the structure to be welded.

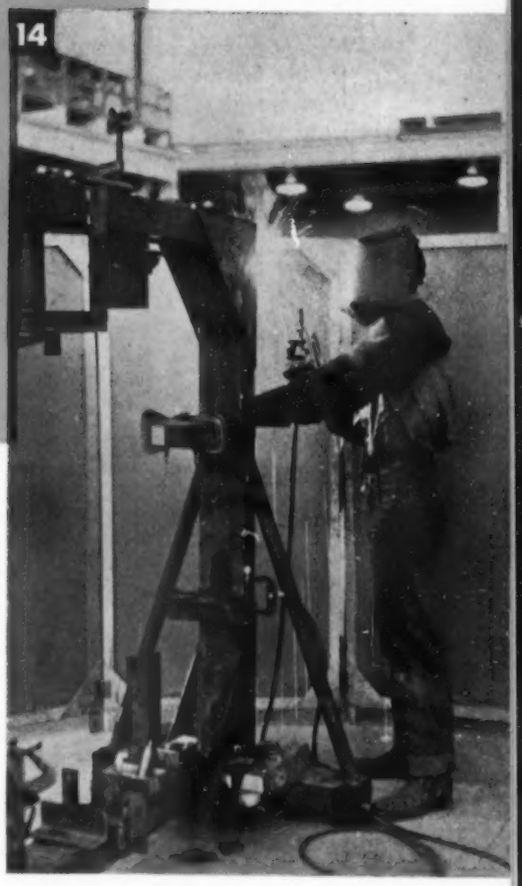
8. Many jigs and fixtures, engine mounts, nacelles, landing gear struts, and similar parts are assembled by electric arc welding in the aircraft industry. It is of interest to note that an inexperienced arc welder usually needs at least a year to become sufficiently skilled to do the type of work required in aircraft production.

9. Automatic and semi-automatic welding equipment, well proven by industry in many applications, will find much use in the production-for-defense program once industry really gets under way. Such units as this "Electronic Tornado" automatic welding head will have application in the manufacture of units for both the Army and the Navy.

10. Note the size of this jig, which is used to align parts welded together to form an engine mount for a V-type engine. The oxy-acetylene process is used for this welding operation in Consolidated Aircraft Corporation's plant at San Diego.

11. Two resistance welding machines built by Federal Machine & Welding Company, said to be the largest both in size and capacity in the aircraft industry, have been installed by Lockheed Aircraft Corporation to speed the production of airplanes for our armed forces. These machines are capable of welding two sheets of aluminum alloy $\frac{1}{8}$ in. thick with the 50-in. long welder arms spaced 18 in. apart. The wide arm spacing is necessary to permit welding of curved forms.

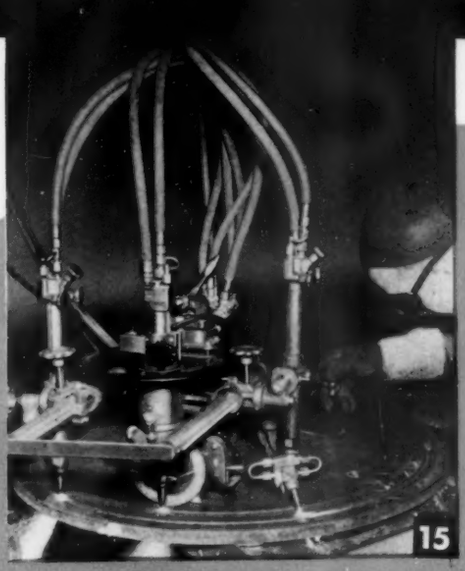




12. Welding specifications for assemblies required by the Army and Navy frequently specify that all structures be positioned so that welds can be made in a horizontal position. For economical production, therefore, weld positioners like this motor-operated unit will be essential. The assemblies to be welded usually are tacked together in alignment fixtures, then transferred to the positioning tables for final welding.

13. Many of the engine manifolds in service on commercial airline planes in the United States, and on a high percentage of all military planes, are manufactured by Solar Aircraft Company in San Diego. These manifolds are fabricated from stainless steel sheet stock of 0.038 or 0.043 in. thickness. The oxy-acetylene process is used, and because of the thin sections, the welding operation is critical.

14. A major program of aircraft construction jig building has been under way at the Northrup Aircraft plant for the past six months, and at present is continuing at an accelerated pace due to the expansion of our defense program. All assembly jigs are electric arc-welded because this method is more rapid, and does not distort the jig structure.



15. Oxy-acetylene cutting and beveling of stiffener rings for brake drum flanges to be used on ship winches illustrates an adaption of portable cutting machines for meeting special requirements. This "Oxweld" unit is equipped with three blowpipes, the first for cutting the outside diameter of the ring, the second for cutting the inside diameter, and the third for beveling the outside diameter for subsequent welding to the drum by "Unionmelt" welding. Three rings are cut, one inside the other, from a single square plate.

16. Oxy-acetylene gouging is used principally for gouging out the back side of electric welds to prepare the plate for rewelding. Single V butt welds are used on the bottom plates of some welded ships. In this instance, the plates are 7/8 in. thick and are butt-welded from the inside by the "Unionmelt" process. A gouging torch then is used for grooving the underside of the weld.

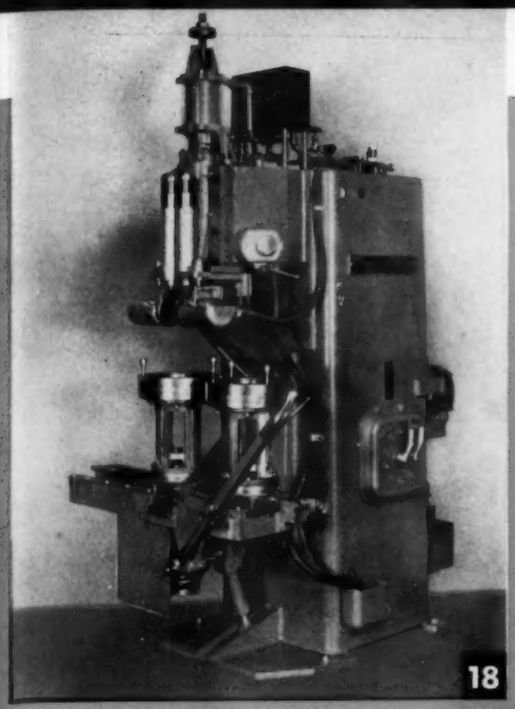
17. The cost of producing many subassemblies for metal airplanes can be reduced considerably through the application of spot-welding in place of riveting, where conditions permit. The above photograph shows an electronically-controlled spot-welder in use on an aluminum alloy fuselage section. Spot welders developed for the aircraft industry ordinarily have considerable throat depth.

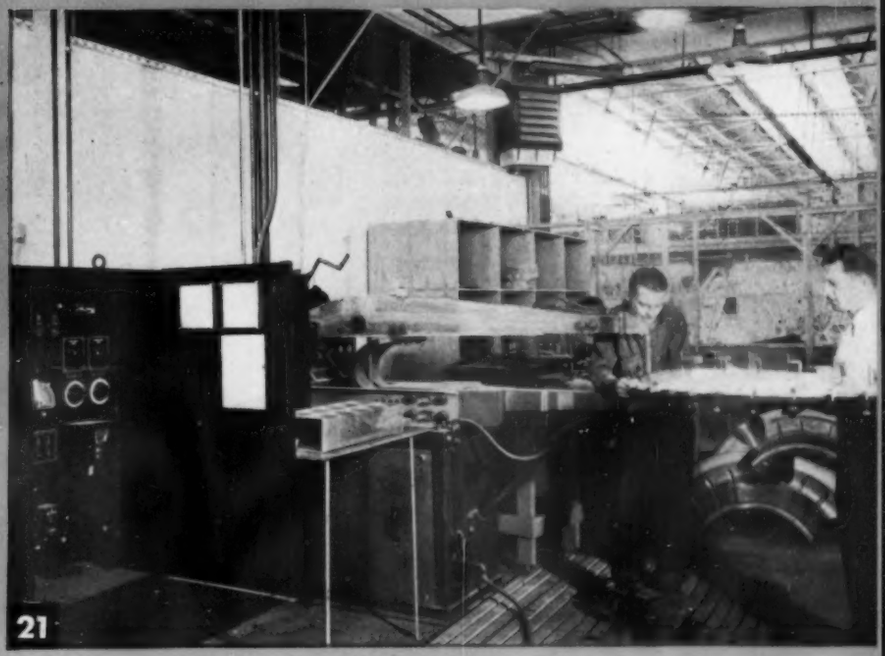
WELDING FOR DEFENSE

18. Base covers for shell are bright soft annealed circular disks of sheet steel that are attached to the base of the shell by over-lapped spot or seam welding (*AM*—Vol. 84, page 667). The machine developed by Thomson-Gibb for this operation on 75mm. and 3-in. shell is standard, except for the tandem fixture. To make welds, the operator puts a shell casing in each chuck, places a disk in position on the base of each, brings the welding wheels into position over one of the stations and starts the shell to rotating by pressing a pushbutton. Welding current automatically is applied while the shell is rotated 180 deg. When the first weld is complete, the operator shifts the slide to the second position and starts the second cycle. While the second shell is being welded, the first station is unloaded and reloaded.

19. This Sciaky stored-energy type spot-welder installed in the North American Aviation plant is shown spot-welding an aluminum-alloy pilot's seat. In this welder, the pressure and heat-adjustment are the major factors contributing to the quality and strength of welds in aluminum alloys. Although spot-welding of aluminum has been done for many years, it is only recently that this process has been developed to a point where it could be applied satisfactorily in the production of aircraft. When one considers the number of rivets driven in the wing of fuselage of an average airplane, at a cost of 3 to 4 cents per rivet, it is easy to see why satisfactory spot-welding of aluminum-alloys is important.

20. Many of the hull plates for both naval and commercial vessels must be cut to special size and shape, as must

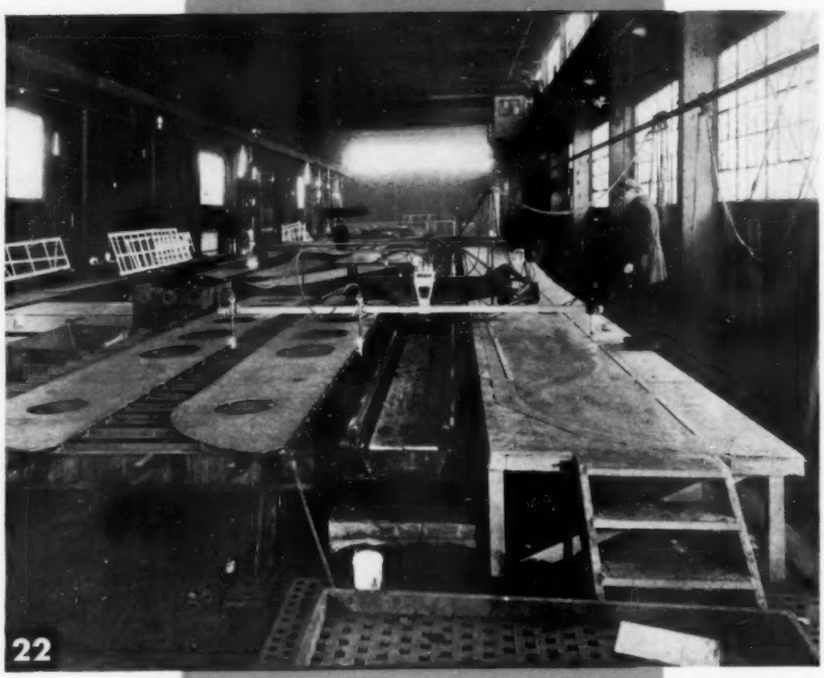




many of the other structural parts inside the ship. Oxy-acetylene cutting machines of both the portable and stationary types are finding considerable application for such work. Some of these plates are lap-welded, and therefore do not require beveling, but in some cases plates must be beveled for butt-welding. The photograph shows an Oxweld portable unit beveling a ½-in. shell plate for the forward part of a tanker.

21. Three basic types of equipment are suitable for spot-welding aluminum and most of its alloys. In addition to the electronically controlled a.c. spot welder, shown here in use in the plant of North American Aviation Corp., there are two types which operate by building up a high electrical charge and then discharging it after the welding tips have been brought against the material under predetermined pressure. Of these, the Sciaky spot welder stores electrical energy in an induction coil so wound that the secondary discharges a high intensity current at low voltage. The second, developed by Taylor-Winfield and described in the "Show-in-Print" section of this issue, incorporates a high-capacity condenser which is charged to a preset voltage which, after a predetermined time, discharges a high intensity current to make the spot weld.

22. One of two large flame-cutting units installed in Eastern shipyards for shaping floor plates and other elements for Class C cargo vessels, this "Travograph" oxy-acetylene unit permits mass production cutting where a number of vessels identical in size and design are under construction in the same yard. The flame-cutting set-ups in these yards probably are the largest installations of their kind at the present time.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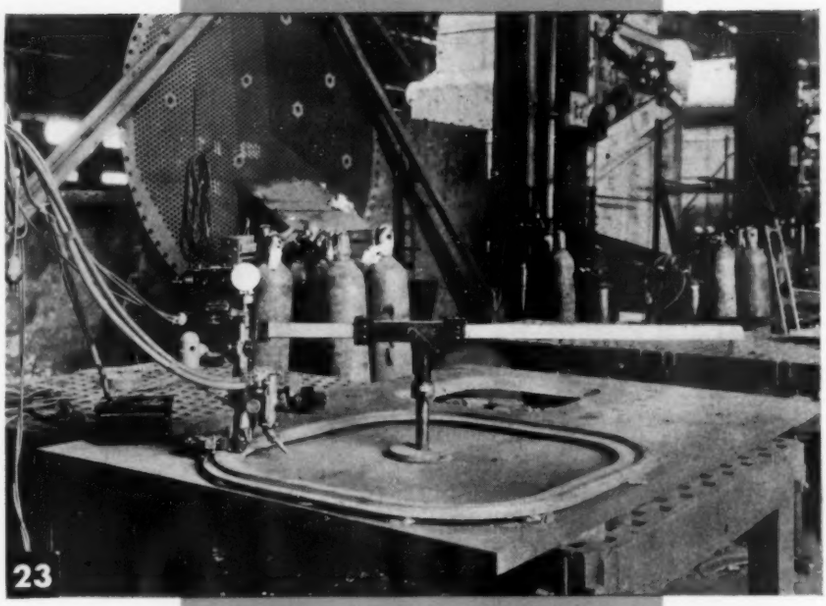
23. Difficult to machine, hatch openings in armor plate can be cut in one continuous operation in this set-up, which incorporates a templet-controlled "Polygraph" oxy-acetylene portable cutting machine. Torch and driving units are mounted together in this unit.

24. Flame-cleaning of structural steel assemblies prior to painting finds a major application in the ship-building industry. Here, a flame-cleaning torch is being used for cleaning rusted bulkhead plates in the engine room of a tanker. Immediately following the operator is shown a second man who goes over the flame-cleaned surface to remove the loosened scale with a wire brush. Paint then is applied so as to take advantage of the heated metal, which takes paint well.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This section was made possible through the cooperation of the following organizations:

AIR REDUCTION SALES COMPANY
ALLIS-CHALMERS MANUFACTURING COMPANY
AMERICAN GAS FURNACE COMPANY
CONSOLIDATED AIRCRAFT CORPORATION
DOUGLAS AIRCRAFT COMPANY
THE ELECTRIC FURNACE COMPANY
GENERAL ELECTRIC COMPANY
GEORGE J. HAGEN COMPANY
HEVI DUTY ELECTRIC COMPANY
LEEDS & NORTHRUP COMPANY
LINCOLN ELECTRIC COMPANY
LINDBERG ENGINEERING COMPANY
THE LINDE AIR PRODUCTS COMPANY
LOCKHEED AIRCRAFT CORPORATION
NORTH AMERICAN AVIATION, INC.
NORTHRUP AIRCRAFT, INC.
REPUBLIC STEEL CORPORATION
SOLAR AIRCRAFT COMPANY
SURFACE COMBUSTION CORPORATION
THOMSON-GIBB ELECTRIC WELDING COMPANY
UNITED AIRCRAFT CORPORATION
UNITED STATES NAVY
WESTINGHOUSE ELECTRIC & MFG. CO.
WRIGHT AERONAUTICAL CORPORATION

24

The Working of CARBON SHEET STEEL

THE PROCESS of rolling sheets was invented in England in the 18th Century. It appears that the first American sheet rolling mill was built in Pittsburgh in 1818 by the Pittsburgh Steam Engine Company under the superintendence of Joshua Malen. Today, about half of the steel made in the United States is now applied to the production of flat-rolled products.

The classifications of flat rolled steel products are listed in Table I. The United States Standard gages for sheet steel are given in Table II. The U. S. gage is a weight gage and not a thickness gage, being based on 41.82 lb. per sq. ft. per inch of thickness—the density equivalent of steel. Prior to 1938, this equivalent was 40.8 per sq. ft. per inch of thickness, but later 2½ per cent tolerance was added to the base weight to allow for crowning.

TYPE OF STEEL USED

Both low-carbon rimmed and killed steel are used for flat-rolled products. The rimmed steel has a thicker skin, which results in a sheet comparatively free from surface defects. A killed steel generally has a more sensitive skin which ruptures easily. For this reason, rimmed steels are almost universally used for sheet steel. However, killed steels have certain advantages such as uniformity of analysis, and comparative freedom from aging, the latter of which increases hardness and decreases ductility.

The composition of some of the higher grade of sheet steels is given in Table III. Except for vitreous enameling sheets it is desirable to keep the carbon content over 0.03 per cent. Manganese is important in improving surface toughness in drawing, but it apparently can contribute to blisters in pickling and galvanizing when its presence exceeds certain limits. If the manganese falls much below 0.20 per cent in rimmed steel, the rolled surface tends to be porous.

ANNEALING PRACTICES

Hot-reduced and cold-reduced sheet and strip steel must be annealed, unless a hard temper is desired. There are a number of annealing operations used, the most important of which are (1) the cold-strain low-temperature recrystalization anneal, (2) the normalizing operation, and (3) the stress-relieving anneal.

The cold-strain low-temperature recrystallization anneal is carried out by covering stacks of sheets or coils placed on a bottom plate, heating to 1,200–1,400 F., and allowing them to soak until the temperature is uniform throughout the charge. The charge is allowed to cool before uncovering. Material that has been cold-reduced or descaled before annealing is usually annealed in a protective atmosphere or "bright annealed" in order to prevent the formation of oxide on the sheet.

Normalizing consists of heating the sheet or strip to above the critical temperature and cooling to room temperature. This recrystallizes and refines the grain structure and improves drawing properties. The grain size and hardness of normalized material can be controlled by varying the soaking time and cooling rate.

The stress-relieving anneal is a low-temperature pack or box anneal used

Table I—CLASSIFICATION BY SIZE OF FLAT-ROLLED STEEL

Widths, In.	*Thickness, In.*						
Hot rolled	0.2500 or thicker	0.2499 to 0.1875	0.1874 to 0.0568	0.0567 to 0.0344	0.0343 to 0.0255	0.0254 to 0.0142	0.0141 to thinner
Up to 3½	Bar	Strip	Strip	Strip	Strip	Sheet	Sheet
3½ to 6	Bar	Strip	Strip	Strip	Sheet	Sheet	Sheet
6 to 12	Plate	Strip	Strip	Sheet	Sheet	Sheet	Sheet
12 to 32	Plate	Sheet	Sheet	Sheet	Sheet	Sheet	T.M.Black
32 to 48	Plate	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet
Over 48	Plate	Plate	Sheet	Sheet	Sheet	Sheet	.....
Cold rolled							
Up to 12	Bar	Strip	Strip	Strip	Strip	Strip	Strip
12 to 24	Strip*	Strip*	Strip*	Strip*	Strip*	Strip*	Strip*
12 to 24	Sheet**	Sheet**	Sheet**	Sheet**	Sheet**	Sheet**	T.M.Black**
24 to 32	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet	T.M.Black
Over 32	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet	Sheet

* When a definite temper as defined is A.S.T.M. specification A-109, or a special edge, or special finish is specified.

** When no special temper, edge or finish is specified.

This section was made possible through the cooperation of the following companies:

Abrasive Company
Air Reduction Sales Company
Allegheny-Ludlum Steel Corporation
American Rolling Mill Company
American Society for Metals
American Welding Society
Carboloy Company, Incorporated
Carnegie-Illinois Steel Corporation
Cincinnati Shaper Company
Cleveland Crane & Engineering Co.
Cleveland Twist Drill Company
Cochrane-Bly Company
Continental Machines, Incorporated
E. F. Houghton & Company
Lincoln Electric Company
Linde Air Products Company
Morse Twist Drill & Machine Company
National Twist Drill & Tool Company
Norton Company
Republic Steel Corporation
Socony-Vacuum Oil Company
The Texas Company
Vanadium Alloys Steel Corporation
Victor Saw Works, Incorporated
Westinghouse Electric & Manufacturing Company

Table II—U. S. STANDARD GAGE FOR SHEET STEEL

Gage No.	Oz. per sq. ft.	Lb. per sq. in.	Lb. per sq. ft.	Inch equivalent for thickness
3	160	0.069444	10.0000	0.2391
4	150	0.065104	9.3750	0.2242
5	140	0.060764	8.7500	0.2092
6	130	0.056424	8.1250	0.1943
7	120	0.052083	7.5000	0.1793
8	110	0.047743	6.8750	0.1644
9	100	0.043403	6.2500	0.1495
10	90	0.039062	5.6250	0.1345
11	80	0.034722	5.0000	0.1196
12	70	0.030382	4.3750	0.1046
13	60	0.026042	3.7500	0.0897
14	50	0.021701	3.1250	0.0747
15	45	0.019531	2.8125	0.0673
16	40	0.017361	2.5000	0.0598
17	36	0.015625	2.2500	0.0538
18	32	0.013889	2.0000	0.0478
19	28	0.012153	1.7500	0.0418
20	24	0.010417	1.5000	0.0359
21	22	0.0095486	1.3750	0.0329
22	20	0.0086806	1.2500	0.0299
23	18	0.0078125	1.1250	0.0269
24	16	0.0069444	1.0000	0.0239
25	14	0.0060764	0.8750	0.0209
26	12	0.0052083	0.7500	0.0179
27	11	0.0047743	0.6875	0.0164
28	10	0.0043403	0.6250	0.0149
29	9	0.0039062	0.5625	0.0135
30	8	0.0034722	0.5000	0.0120
31	7.00	0.0030382	0.437500	0.0105
32	6.50	0.0028212	0.406250	0.0097
33	6.00	0.0026042	0.375000	0.0090
34	5.50	0.0023872	0.343750	0.0082
35	5.00	0.0021701	0.312500	0.0075
36	4.50	0.0019531	0.281250	0.0067
37	5.25	0.0018446	0.265625	0.0064
38	4.00	0.0017361	0.250000	0.0060

to remove internal stresses produced either by the rapid cooling in the normalizing operation of by leveling or light-rolling operations after normalizing. It improves drawing properties. Temperatures used range from 950 to 1,200 F. A protective atmosphere can be used under the cover to prevent oxidation. The charge may be steam blued if desired by addition of steam under the cover after the removal of the charge from the furnace when the temperature has dropped from 200 to 400 F. below that of the furnace.

Typical physical properties of mild steel sheets and strips after annealing operations are given in Table IV.

The surface texture of sheet and strip can be varied between wide limits, depending upon the surface treatment. For plating and similar uses, a smooth bright surface is necessary, but for vitreous enameling and many drawing operations, a certain dullness or roughness of surface is more suitable. Rough surfaces improve adherence for enameling and similar finishing. In certain drawing operations where heavy pressures are developed, the duller type of surface draws better.

TYPES OF SHEET STEEL

Cold rolling is practiced to obtain or develop certain qualities and properties, which may be classified as follows: (1) sizes thinner than that possible by hot rolling, (2) desired surface finish, (3) definite hardness or temper, (4) controlled edge characteristics. As the cold work on sheet and strip increases, the hardness is correspondingly raised. Cold-rolled material is produced in five different tempers as follows: No. 1, full hard; No. 2, half-hard; No. 3, quarter-hard; No. 4, soft or planished; and No. 5, dead soft. The approximate physical properties of each of these tempered steels, together with recommended uses, are given in Table V.

Fabricators of products made from flat-rolled sheet and strip can obtain the steel in the following forms:

1. *Hot-Rolled*—This term is usually applied to No. 16 gage and heavier products rolled on continuous hot-strip and jobbing sheet mills.

2. *Hot-Rolled and Normalized*—Hot-rolled sheet and strip in heavy gages are too hard for many purposes, and are usually normalized to increase their adaptability for fabricating operations.

3. *Hot-Rolled Pickled*—Sheet and strip are hot-rolled and pickled to remove the oxide coating in order to make them more suitable for die forming, welding, and application of protective coatings.

4. *Hot-Rolled Annealed*—This includes No. 17 gage and lighter sheet and strip which are first hot rolled, then cold rolled and box annealed; also, hot rolled, box annealed and cold rolled or roller levelled to flat. The sheet and strip have moderately good forming properties.

5. *Hot-Rolled, Pickled and Annealed*—Such sheet and strip are identical with hot-rolled annealed products, except that in this case hot-rolled sheet is pickled to remove oxide, flattened and box annealed.

6. *White-Finished Hot-Rolled Pickled and Annealed*—Such sheet and strip are identical with hot-rolled,

Table IV—PROPERTIES EFFECTED BY TREATMENT

Sheet Treatment	Tensile strength, lb. per sq. in. Yield	Tensile strength, lb. per sq. in. Ultimate	Elongation, % in 2 in.	Hardness, Rockwell B	Olsen cup, 0.04 in. thick
Hot-rolled sheet	50,000	68,000	10	70	0.200
Hot-rolled coiled strip	45,000	55,000	30	60	0.350
Hot-rolled + normalized	38,000	52,000	32	55	0.365
Hot-rolled + second anneal	30,000	48,000	38	50	0.390
Hot-rolled + cold reduced	85,000	85,000	4	90	0.120
Hot-rolled + bright anneal	28,000	45,000	42	45	0.410
Hot-rolled + normalize + second anneal	32,000	50,000	38	52	0.390

Table III—TYPICAL COMPOSITIONS FOR SOME HIGHER GRADE SHEETS

Grade of quality	Composition, per cent: Carbon	Manganese	Phosphorus	Sulphur	Silicon
Ordinary requirements, mild forming	0.05–0.08	0.20–0.35	0.005–0.05	0.005–0.05	Trace–0.008
Cold-forming, full cold-rolled stock	0.10–0.15	0.35–0.45	0.005–0.05	0.005–0.05	Trace–0.008
Cold-drawing, full cold-rolled stock	0.07–0.10	0.35–0.45	0.005–0.05	0.005–0.05	Trace–0.008
Automobile sheets	0.05–0.08	0.25–0.50	0.30 max.	See Note A	Trace–0.008
Deep-drawing stock	0.09–0.15	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Extra-deep-drawing stock	0.02–0.10	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Difficult drawing stock	0.02–0.08	0.30–0.40	0.005–0.05	0.005–0.05	Trace–0.008
Furniture stock	0.08–0.12	0.35–0.45	0.050–0.10	0.005–0.05	Trace–0.008
Surface important, painting, lithographing	0.05–0.08	0.25–0.50	0.005–0.05	See Note A	Trace–0.008
Vitreous enameling	0.03 max.	0.10 max.	See Note A	See Note A	Trace–0.008

Note A: Keep this element as low as possible.

Table V—APPROXIMATE PHYSICAL PROPERTIES OF COLD-ROLLED STOCK

Grade or temper	*Hardness, Rockwell B*	*Depth of cup for 0.05 in. thickness of strip, mm.**	*Ultimate tensile strength,** lb. per sq. in.*	*Elongation, % in 2 in. for 0.05 in. strip thickness†*	*Remarks*
No. 1, hard	90 ± 6‡	6– 7	80,000 ±12,000	3 ± 2	Intended for flat blanking only.
No. 2 half hard	80 ± 5	7– 8	64,000 ± 8,000	9 ± 5	Intended for easy bending up to 90 deg. across the grain. No bending along the grain.
No. 3 quarter hard	69 ± 5	8– 9	54,000 ± 6,000	20 ± 7	For shallow drawing and stamping, where a very smooth surface is required. Bends 180 deg. across the grain and 90 deg. along the grain.
No. 4, soft or planished	58 ± 6	9–10½	48,000 ± 5,000	30 ± 6	For fairly deep drawing where no surface strain is permissible. Bends 180 deg. both ways of the grain.
No. 5, dead soft	45 ± 7	10–11½	44,000 ± 4,000	39 ± 6	For deep drawing where slight stretcher strains are permissible. Bends 180 deg. both ways of the grain.

* Cup depth varies with thickness of strip. For grade No. 5, the depth is given approximately by the formula: D = 10.5mm. + 6.4 log t, where t = thickness in mm. Other tempers vary in a similar way.

** Tensile properties are based on the standard tension test specimen for sheet metals, Fig. 7, A.S.T.M. Designation E8, A.S.T.M. Standards, 1936, Part 1, P. 833.

† Elongation in 2 in. varies with the thickness of strip. For Grade No. 5, the percentage elongation = 41 + 10 log t, where t = thickness in mm. Other tempers vary in a similar way.

‡ For cold strip 0.069 in. and thinner, the Rockwell B hardness range is 96 ± 6, with corresponding increase in tensile strength and drop in depth of cup test.

pickled annealed stock, except that they may be pickled last or deoxidized in box annealing to remove annealing oxide when it would be objectionable in fabricating.

7. *Extra-Smooth Hot-Rolled Annealed*—This product is identical with hot-rolled annealed stock, except that it is given a full cold-rolling to develop the desired smoothness.

8. *Blued Sheet*—Such sheets are submitted to processes designed to produce uniformly coated surfaces with light oxide films, usually having a color of some shade of blue.

9. *Specially Processed Sheet*—In addition to the above treatments, various uses to which sheets are applied require special processing. Among these may be mentioned vitreous enameling, which requires a special surface adapted for increasing the adherence of the enamel.

10. *Oiled Sheet and Strip*—These products are coated with oil to preserve them from rusting for short periods. Usually, the treatment consists of pickling, rinsing with water, washing with an alkaline solution, drying rapidly and oiling.

SURFACE TREATMENTS AND COATINGS

Iron oxides, loose dirt, oils and grease must be removed from the surface of sheets and strip steel before they can be fabricated into products. The methods and materials for cleaning and descaling sheet and strip metal are listed in Table VI.

Coating materials for sheet and strip steel are of two kinds, metallic and non-metallic. The latter is comprised of mixtures of organic or combined organic and inorganic origin. Coatings may be applied for lasting or long-time protection, but coatings that will afford temporary protection and that are easily removed or that possess properties which permit the steel to be used without their removal are important.

METALLIC COATINGS

Metals used for coating sheet and strip steel, in order of their importance include tin, zinc, terne metal, nickel, chromium, cadmium, copper, aluminum, bronze, cadmium-tin alloy, silver, gold, lead, iron and steel. These are applied to steel surfaces by the following six methods:

1. *The Hot-Dip Process*—In this process the article to be coated is immersed in a molten bath of zinc, tin or terne metal. The most suitable temperature for the molten bath is between 50 and 100 F. below that temperature at which the molten bath will attack the metal being coated or the metal from which the bath is constructed. For example, pots in which steel is galvanized will be attacked rapidly by zinc at 900 F., for which reason the best temperature of the bath has been found to be between 790 and 850 F.

2. *Surface Absorption or Metallic Cementation Processes*—Coatings of zinc, aluminum and silicon are successfully applied by these methods. They are known as sherardizing, calorizing and Ihrigizing.

In sherardizing, the parts to be coated are usually small articles which are thoroughly cleaned by pickling or sandblasting, packed in metal drums with fine zinc dust, and heated for several hours to 650 to 750 F. The drums are slowly rotated in the furnace during heating. The surface produced affords good protection against atmospheric corrosion.

In calorizing, developed by General Electric Company, thoroughly cleaned steel articles are packed in steel drums containing a mixture of alumnium and aluminum oxide. A reducing gas is passed into the drum which is rotated in a furnace and heated for about five hours to between 1,730 and 1,750 F. The aluminum coating protects the steel from oxidation at elevated temperatures.

Ihrigizing is a special type of siliconizing, or impregnating the surface of low carbon steels with silicon. The surface of the steel must be cleaned of sand and heavy scale, packed with silicon carbide or ferrosilicon, heated to 1,700-1,800 F., and exposed to the action of chlorine from two to six hours. The siliconized layer, usually 0.005 to 0.1 in. thick

Table VI—METHODS IN COMMON USE FOR CLEANING AND PICKLING

Type	*Method*	*Material used*	*Removes*	*Remarks*
Mechanical	Brushing	Steel brush	Loose dirt, rust, scale	
Mechanical	Air blast	Compressed air	Loose dirt	
Mechanical	Sand or metal blast	Sand or metal particles + compressed air	Loose dirt, rust, scale	
Mechanical	Bending or stretching		Heavy scale	
High-temperature chemical	Deoxidizing with gases	Hydrogen, methane, mixture of carbon monoxide and other gases	Thin films of oxides, organic substance, oil	Heat the material in the presence of the reducing gases. Oxides are reduced. Organic matter is decomposed.
High-temperature chemical	Liquid bath	Fused sodium carbonate + sodium cyanide	Thin films of oxides, oil, organic substance	Oxide is reduced and surface metal is nitrided, or carburized and nitrided, to form a film resistant to atmospheric corrosion.
High-temperature electrochemical	Electrolytic bath	Fused sodium hydroxide	Oxide films	NaOH is the electrolyte and the steel the cathod; use 100–150 amps. per sq. ft.
Chemical	Alkaline bath	Solutions of soaps, caustic soda, trisodium phosphate	Oil and grease	
Chemical	Liquid bath	Emulsifying solutions	Heavy oil and grease	
Chemical	Acid bath-pickling	Inorganic acids: sulphuric; hydrofluoric + nitric; phosphoric	Oxides and scale	Sulphuric acid most commonly used; sulphuric (or nitric) + hydrofluoric acids for stainless and heat-resistant steel; phosphoric acid is slow and costly, but after pickling articles are more rust resistant.
Electrolytic	Alkaline bath	Meta- or orthosilicate of soda in concentrations of 3 or 4 oz. per gal. of water	Oil	Two-step cleaning: First spray solution at 200 F. in hooded tank. Second, place in tank with electrolyte near boiling; the article is the cathode; use 10 volts, 30 amps. d.c. per sq. ft. Finally, brush and wash with water at 120 F.
Electrolytic	Acid bath-pickling	Sulphuric acid	Oxide and scale	Cowper-Coles method: Acid is electrolyte; article is cathode; lead bars for anode; direct current of 8 volts.
		Sulphuric or sulphurous acid	Oxide and scale	Reed's method: Uses acid of 1.06–1.25 specific gravity and temperature not over 140 F.; d.c., 0.4–0.7 amps. per sq. decimeter.
		Bisulphates or bisulphates + sulphuric acid	Oxide and scale	Danforth and Jones method.
		Phosphoric acid + trisodium phosphate	Oxide and scale	Marino method: Use 10% solution of acid and phosphate as electrolyte at 140 F.
		Hydrochloric or sulphuric acid	Oxide and scale	Avery method: Use 5% solution of the acids; nickel or carbon bars as anodes; direct current of 4–6 volts and 20 amps. per sq. decimeter.
		Sulphuric acid	Oxide and scale	Hanson - Van Wrinkle - Munning two-step method: First, the article is cathode in 10–20% solution of acid under 25 to 125 amps. d.c. per sq. ft. Second, article is transferred to 50% solution of acid under same current density. With d.c. of 100 amps. and solution at 90 F., low-carbon steel articles can be bright cleaned in 2 to 5 min.
Electrolytic	Acid + alkaline baths	Sulphuric acid hydrochloric acid, sodium chloride, caustic soda, trisodium phosphate	Oxide, scale, oil and grease	Bullard-Dunn process: Two electrolytes, one acid and one alkaline are used; lead anodes; article cleaned is cathode. Acid electrolyte: 3 oz. each per gal. of sulphuric acid, hydrochloric acid and sodium chloride to remove oxide and scale. Alkaline electrolyte: 3 oz. soda ash, 4 oz. trisodium phosphate, and 9 oz. caustic soda per gal. water to remove oil and grease. As scale is removed, lead film forms which is removed by reversing current quickly.

NOTE: Temperature is the most important factor in controlling the time required for cleaning, and controlling iron loss during pickling. For example, the time for pickling at 190 F. is less than half the time required at 140 F. From room temperature to boiling, the speed of pickling doubles for each rise of 15 to 20 deg. F. Also, the rate of solution of iron at 180 F. is about five times that at 140 F., and at 212 F. it is nearly 100 times that at room temperature. Therefore, the temperature should be maintained as high as possible without pitting the steel or decomposing the inhibitor, and the article should be removed from the bath as soon as it is free from scale.

NOTE: In pickling, inhibitors can be added to the bath which slows down or prevents the action of the acid upon the base metal but permits the reactions that result in removal of the oxide or scale to continue.

is hard and resistant to corrosion by non-oxidizing acids, and to wear and oxidation at temperatures to 1,600 F.

3. *Metal Spraying*—Most of the common metals can be applied to carbon sheet-metal articles by metal spraying. The metal to be coated is drawn into a wire and fed into the spray gun, where it is melted by acetylene or hydrogen flame. It is picked up and atomized by a compressed air nozzle and projected against the surface to be coated. The impact causes it to adhere to the steel surface, providing it is perfectly clean and free of oil.

4. *Copper Cladding*—In this process, the steel is cleaned perfectly, mounted on a covered mold, and heated out of contact with air to a temperature slightly above the melting point of the copper. The copper is then cast above the steel base. Other methods consist in dipping the steel core into a bath of molten copper and depositing the copper electrolytically. Semi-finished products prepared by this method may be heated to around 170 F. and hot-rolled, then finished by cold rolling or drawing as in regular copper-forming work.

5. *Aluminum Cladding*—This is accomplished by rolling flat steel almost to gage, cleaning it perfectly, placing it between two sheets of aluminum and then cold rolling. However, it may be heated to between 600 and 700 F. and rolled. The latter method results in a better bond of the aluminum with the steel. Subsequent annealing above 1,000 F. causes the aluminum to unite with the iron forming a very brittle iron aluminate.

6. *Electroplating*—This is the most widely used method for applying metallic coatings to articles fabricated from sheet steel. The base metal must be cleaned of oil, grease, dirt and scale by methods such as specified in Table VI. A few typical plating baths, with operating data, are given in Table VII.

NON-METALLIC COATINGS

Non-metallic coatings are of two classes, organic and vitreous. Organic coatings are commonly known as paints, varnishes, enamels, lacquers and japans, the pigment being generally of inorganic origin. In many cases, rust inhibiting or bonding treatments are applied to effect a better bonding of the paint film with the steel surface and to inhibit corrosion effected through porosity of this film. This can be accomplished by treating the clean surface of the steel with manganese dihydrogen phosphate. Also, after cleaning, the steel can be dipped into a rust-proofing solution of copper salt and phosphoric acid, kept at a temperature of 140 F. Oxalic acid may be substituted for phosphoric acid, when the baking temperature used is below 300 F. Another inhibiting solution is chromic acid and sodium chloride which can be sprayed upon the cleaned sheet at a temperature of about 180 F. Other methods include electroplating in a zinc phosphate solution, spraying with a mixture of phosphoric acid and oxalic acid, and spraying with a solution made up of zinc nitrate, sodium bisulphate and sodium acetate. The latter is known as zincoting. It requires rinsing with water and a dilute solution of zinc chromate after spraying.

Vitreous coatings, commonly known as vitreous enamels, to distinguish them from enamels of organic origin, correspond to a layer of glass fused to the properly prepared surface of steel. The one particular requirement of such coatings is that it must have a coefficient of expansion approximating that of iron or steel. To apply these coatings, the formed sheet-metal articles are degreased, pickled in acids, rinsed in a neutralizing bath, washed, dried, immersed in a water suspension of pulverized

Table VII—TYPICAL BATHS FOR ELECTROPLATING CARBON SHEET STEEL

Kind of coating	*Type of coat*	*Typical composition of baths per gallon of water*	*Operating conditions* pH	Temperature, F.	Amperes per sq. ft.	Volts
Nickel	Watts or dull	40 oz. nickel sulphate, 8 oz. nickel chloride, 5 oz. boric acid	1.5–2.5	110–125	40	.....
	Bright	40 oz. nickel sulphate, 6 oz. nickel chloride, 4½ oz. boric acid, + 1 or 2 per cent addition agents	2.0–5.0	125–140	10	.....
	Hard	16 oz. nickel sulphate, 2.8 oz. ammonium sulphate, 1.1 oz. potassium sulphate	5.2–5.8	120–130	20–35	.....
Chromium	Bright	25–55 oz. chromic acid, 0.35–0.55 oz. sulphuric acid	.....	110–120	150–300	3.5–6
	Hard	35–55 oz. chromic acid, 0.2–0.7 sulphuric acid	.....	140–150	200–300	.....
Zinc*	Acid	32 oz. zinc sulphate, 2 oz. sodium acetate, 4 oz. aluminum sulphate, + 13 oz. addition agent (licorice)	2.5–4.0	70	25	.....
	Cyanide	8 oz. zinc cyanide, 3 oz. sodium cyanide, 7 oz. sodium hydroxide, + ⅛ oz. brighteners (mercuric salts)	12.0–12.2	100–110	30	4–10
Cadmium	.....	3 oz. cadmium oxide, 13 oz. sodium cyanide, + brighteners	13.0	70	25	.....
Tin	Alkaline	16 oz. sodium stannate, to 4 oz. sodium hydroxide, + addition agent	.....	140	10–40	4.5
	Acid	8 oz. stannous sulphate, 9 oz. sulphuric acid, 7 oz. cresol sulphonic acid + addition agent	.....	70	35	1.1
Copper	Cyanide	3 oz. copper cyanide, 4.5 oz. sodium cyanide, 6 oz. potassium tartrate, 2 oz. sodium carbonate	11.8–12.2	160–180	30	.....
	Acid	28 oz. copper sulphate, 11 oz. sulphuric acid	.....	70–80	30	.....
Brass	.....	3.6 oz. copper cyanide, 1.2 oz. zinc cyanide, 7.5 oz. sodium cyanide, 4 oz. sodium carbonate	11.0	110	10–12	.....

* Articles electroplated with zinc may be made black in color by immersing in Antimony Black (4 oz. sodium hydroxide + ¼ oz. antimony oxide per gal. of water) or Nickel Black (4 oz. nickel chloride + 6 oz. ammonium chloride + 2 oz. sodium sulfocyanide + ½ oz. zinc chloride + ¼ oz. copper carbonate per gal. of water). These solutions should be heated to 120 F.

enamel ingredients, allowed to drain, dry, heated at 1,500–1,600 F. from 1 to 4 min., and cooled to room temperature. Additional coatings may be applied by dipping in a water suspension of pulverized enamel ingredients of the desired composition. They should be dried, and fired at 1,450–1,500 F. for one to three minutes.

Black oxide coatings are used on sheet-steel products. For such coatings, the steel is cleaned and heated to 1,200 F. for about seven hours in closed retorts in which the air is displaced by a mixture of steam and vaporized benzine, then cooled to 300 F., dipped in hot boiled linseed oil and kept at this temperature until the oil has become oxidized. The benzine helps to produce a substantial coating.

POLISHING AND BUFFING

Polishing operations are classified as (1) roughing, (2) dry fining, (3) oiling out or greasing, and (4) grease-finishing or finishing. Fused crystalline aluminum oxide abrasives are used in these operations. The recommended grain sizes for the various operations are Nos. 20 to 80 for roughing; Nos. 80 to 120 for dry fining; Nos. 120 to 180 for greasing; Nos. 180 to 280 for finishing.

For some types of work all of these polishing operations may be successively performed on various articles, while for others only one or two may be necessary to produce the required surface characteristics. For example, when preparing products for paint or lacquer finishing, Nos. 80 to 150 abrasives can be used, but when they are to be plated all four polishing operations may have to be used.

The most common type of polishing wheel is made up of woven cotton fabric, sewed or stitched together and then screwed or cemented to form a wheel of the desired thickness and density. Wheels are made of canvas belting, woven cloth, sheepskin, sewed buck, wool felt, leather, walrus hide wood blocks. Walrus hide is tough and springy, and can be cleaned by soaking in solvent if used for oiling out or greasing operations. Fine cloth, sheepskin and wool-felt wheels are used for certain dry fining operations and greasing work. Leather-covered wood wheels are frequently used for polishing flat work where a slight cushion with a solid backing is required. For polishing flat sheets or pieces, abrasive belts can be used instead of wheels.

The density, that is, the resiliency, of the polishing wheel is determined by the sewing of the buff sections and by the extent of the area of the buff that is glued. Buff sections in which the rows of concentric or spiral sewing are spaced closely, say $\frac{1}{4}$ in. apart and which are glued to the buff, form the densest type of cloth wheel. Wheels of lesser density can be made of sections with wider spaced sewing, say from $\frac{3}{8}$ up to $\frac{3}{4}$ in., the glue being stopped between 1 to 4 in. from the periphery of the wheel. A wheel that is not glued up to its periphery, however, has a tendency to separate between the buff sections and to leave streaks on the surface of the work being polished.

The density of polishing wheels can be varied over a wide range by varying the number of blocks of material that are assembled into the wheel. The cushion, that is, the distance that the material projects beyond the side plate of the wheel, also can be varied within certain limits. A cushion of 2 in. is most commonly used, but a 3 in. cushion is used where a particularly yielding wheel is desired, and a 1 in. cushion where the wheel is required to be rigid. Polishing wheels can be made with formed bases to fit the contour of the work being polished.

All polishing wheels should be carefully balanced. Unbalanced wheels produce poor work and have short life; also, they increase the cost of production because extra effort is required to produce good work. Best polishing results are obtained at wheel speeds of 7,500-8,500 surface ft. per min.

For best polishing results, the following points should be observed:

1. The abrasive grain should be accurately graded, clean and uniform in size, shape and grain surface.

2. Use a first quality animal hide glue for assembling wheels.

3. Weigh the glue and cold water carefully before soaking. Proportions of glue and water for the various grain sizes are as follows: For 150–200, 25 per cent of dry glue by weight; No. 100–120, 33 per cent; No. 80–90 grain, 35 per cent; No. 60–70 grain, 40 per cent; No. 46–54, 45 per cent; No. 30–36, 50 per cent.

4. Keep the glue no higher than 150 F.

5. Keep the glue pot, brushes and abrasive clean, free from oil and foreign matter.

6. The abrasive grain and wheels should be heated to about 120 F. before applying the glue.

7. Apply the glue evenly to the surface of the wheel, then roll the wheel in the grain, pressing firmly and evenly so that the grain will be uniformly coated on the wheel.

8. Place the coated wheels in a special drying room, preferably where a constant temperature of 70 F. and a relative humidity of about 50 per cent can be maintained. Allow the wheels to remain until thoroughly dry.

Narrow ledges, corners and other places difficult to reach with the polishing wheel are bound to be poorly finished and may ruin the appearance of the part or article. In such places polishing compounds accumulate and become compact, causing difficulties in subsequent cleaning and plating operations. When designing parts which are to be polished, plated and buffed, designers should keep these facts in mind.

Rough polishing will oxidize the surface of the metal, since the action of the abrasive is of considerable violence and pressure. Blue-colored spots resulting from the heat remain on the polished article after cooling. They are likely to show under paint or lacquer unless greasing or finishing operations are employed.

Some fabricators of sheet-metal products are using satin-finished sheet and strip steel, which eliminates roughing, dry fining and grease polishing operations. However, during forming operations, this satin-finished steel may receive surface markings which can be removed by polishing with abrasives of No. 200–220 grain.

Operators in plants forming articles from satin-finished steel should be trained to the hazards caused by rough handling, scratching and damaging the surface of this steel, especially when the parts are to be eventually plated and buffed. Scratches and die marks are detrimental and cause extra work in polishing; then the expense involved may not justify the high cost of such steel.

After polishing, parts must be degreased for plating or finishing with organic material. Degreasing methods are listed in Table VI.

Not all articles made from carbon

flat-rolled stock need be polished as described above prior to plating. After press-forming (greasing and pickling when necessary), small articles can be burnished with hard-steel balls using trisodium phosphate and soap chips. The length of burnishing operation depends upon the finish desired. Care must be taken so as not to roll over sharp edges on the piece. Often, when there is a sharp edge, this should be removed by emery or sand paper prior to burnishing. Such burnishing is more economical than polishing, and articles properly burnished are capable of receiving a bright nickel or chromium plate, the quality of which on small parts is comparable to that produced on larger parts which have been polished and buffed.

Buffing sheet-metal articles is bound to produce a sheen or luster on the surface. It comprises two operations, cutting down and coloring. The work is performed with a buffing wheel composed of a number of circular cloth disks mounted on an arbor and rotated at speeds ranging from 7,500 to 8,500 surface ft. per min. The wheels are of three types: full-disk buffs, which may be either loose or sewed; sewed-piece buffs, and patented folded buffs. The material is usually cotton sheeting, bleached or unbleached, the most widely used grade having a wrap of 64 threads per inch and a filling of 68 threads, known as 64 x 68 cloth. Another widely used fabric is woven 84 x 92 cloth, which is harder than the 64 x 68 cloth and will stand rougher usage. They are used for cutting down operations, while the 64 x 68 is generally used for coloring. Folded buff consists of full disks folded and assembled in various ways to form pockets, and then are assembled to form a complete circle after which they are either sewed as a loose buff or as a spirally sewed buff. Such buffs are used for both cutting down and coloring. Their use usually results in the elimination of buff marks found with the full-disk or sewed-piece buffs.

Buffs operating under heavy pressure must be ventilated in order to dissipate the heat generated. Folded buffs are designed to provide their own ventilation. Full-disk and sewed-piece buffs may be ventilated by assembling one or two disks of smaller diameter than the buff disk between each pair of buff disks or at such intervals as may be necessary, depending upon the severity of the work.

WELDING

Sheet metal may be butt, flange or lap welded. To obtain consistently a welded seam of good quality, the edges of the sheet-metal members must be well aligned. All dirt, rust, and scale should be removed.

Butt welds usually have additional metal supplied in the form of welding rods. The flanged joint is usually preferred for gas-welding on sheet lighter than 20 gage. The edges are flanged, brought together, and fused down; welding rod is seldom used. Particular care should be taken to secure good penetration and eliminate the film of oxide between the projecting edges.

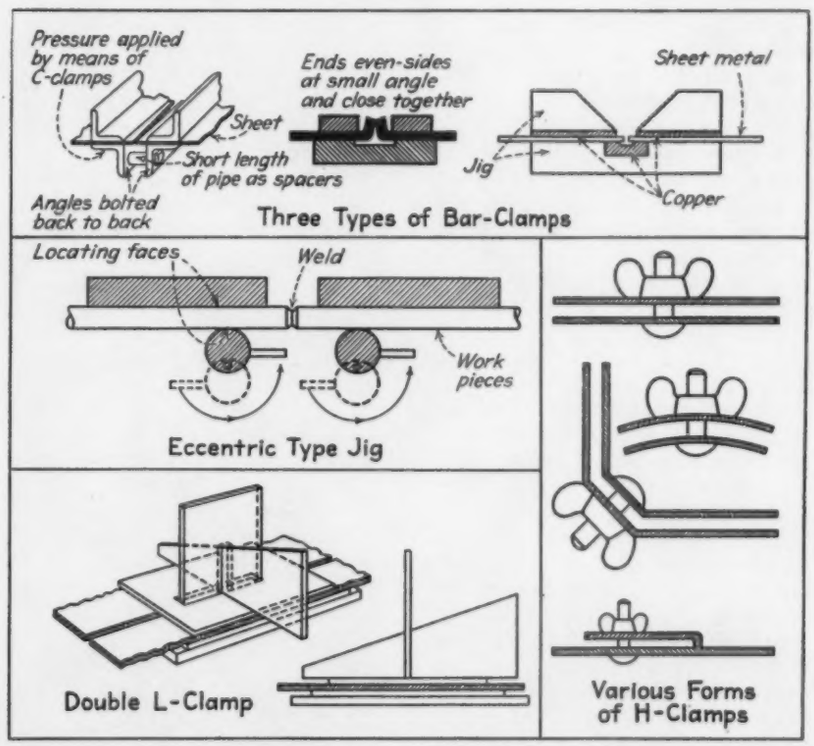
Buckling and bulging, caused by expansion and contraction of the metal resulting from the heat of the welding operation, is the biggest problem in welding sheet steel. Properly designed jigs will prevent such buckling and restrict movement of the sheet. They aid in assembling the various sheet members and in aligning the edges to be joined.

Stagger welding will relieve buckling by evenly distributing the heat over the full length of the seam. In this procedure, the welder welds a few inches at the beginning of the seam, then moves to the center, next to the end of the seam, and finally back to where the first weld ended, repeating the cycle until the weld is completed.

Beading is employed as a means of allowing for expansion and contraction in light sheet. Before the parts are aligned for welding, a bead is run along the sheet parallel to the seam and not more than an inch from the edge. The bead acts as an expansion joint, taking up movement that occurs due to the heat of the operation.

Because of buckling, it is generally advisable to locate a weld at or near a square or rounded corner. Although a corner weld may not decrease the magnitude of the stresses developed, it will restrain the tendency of these stresses to cause buckling. Two sheet-metal members, being in different planes, will act as stiffeners, and oppose deformation in the other plane.

The space allowance between sheets for welding will vary directly with the thickness of the sheet and also



Sheet metal should be securely jigged for welding in order to limit distortion and increase production. The jigs shown embody a number of usual design principles

Table VIII—TYPICAL REQUIREMENTS FOR VARIOUS TYPE WELDS

Gage No.	Electrode size, in.	Position of weld	Butt		Lap		Fillet		Corner		Edge	
			Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts
20	3/32	Flat	30*	18	40*	21	...	...	40*	21	40*	21
		Vertical	30*	18	40*	21	...	...	40*	21	40*	21
		Overhead	30*	18	40*	21	...	...	40*	21	40*	21
18	3/32	Flat	40*	18	60*	22	40*	21	60*	24	60*	23
		Vertical	40*	18	60*	22	40*	21	60*	24	60*	23
		Overhead	40*	18	60*	22	40*	21	60*	24	60*	23
16	1/8	Flat	70*	29	100	25	70*	27	90*	24	80*	25
		Vertical	70*	29	100	25	70*	27	90*	24	80*	25
		Overhead	70*	29	100	25	70*	27	90*	24	80*	25
14	1/8–5/32	Flat	85*	29	130	25	100	25	90	24	110	27
		Vertical	80	29	130	25	90	24	80	28	80	26
		Overhead	85*	29	130	25	85	24	75	25	80	26
12	5/32	Flat	115	25	135	25	150	25	125	24	145	28
		Vertical	110	26	120	26	140	24	110	28	110	26
		Overhead	110	25	120	25	120	24	110	26	110	26
10	5/32–3/16	Flat	135	25	155	28	160	25	140	24	150	28
		Vertical	120	27	130	26	150	24	130	28	120	27
		Overhead	115	25	120	25	130	24	125	26	120	26
8	5/32–3/16	Flat	190	27	165	28	160	25	175	27	160	28
		Vertical	130	27	140	26	160	24	130	28	120	27
		Overhead	120	26	120	25	130	24	125	26	120	27

* Electrode negative and work positive. Electrodes designed especially for thin sheet should be used.

the length of the seam. A good rule-of-the-thumb is to allow a spacing equal to the thickness of the sheet for every foot of weld length. By welding as rapidly as possible, that is, as fast as good welding will permit, the sheet movement and the space allowance between sheets are held to a minimum.

GAS WELDING

In gas welding, the tip should be held at such an angle that the molten metal is not forced ahead of the flame on relatively cool and unfused edges of the sheet. It is a common fault of the welder to hold his tip too nearly parallel to the surface, thus blowing the fluid metal on to sheet edges which are not hot enough to receive it. On the other hand, if the welding torch is held too nearly vertical, it will be difficult to avoid burning holes through the sheet. Metal from the welding rod must flow into the area under the welding flame, and only at the point where the base metal is actually liquid. The quantity of rod added should be regulated so that there will be no tendency for the metal to flow ahead of the welding, resulting in adhesion rather than fusion. The soundness of the weld is dependent upon using the proper blowpipe, tip, gas pressures, and proper size of welding rod.

The strength of a welded sheet is dependent upon thorough penetration. The margin between correct and excess of heat is relatively slight in gas-welding light sheets, and the endeavor to weld through to the under side of the sheet should, therefore, be regulated so that the molten metal will not be lost through the bottom of the weld. If penetration extends through the sheet, grinding or filing will remove most of the irregularities.

ARC WELDING

When welding thin sheet with the electric arc, an electrode having low spatter and slag loss, depositing metal of high quality, should be used. The electrode should usually be negative and a short arc should be used to eliminate tendency for the electrode to stick. Proper current characteristics for welding thin sheet are easily obtained with a 75 to 100-amp. unit. When welding with a higher capacity generator, such as 300 amp., it may be necessary to insert a resistance of approximately one ohm in series with the arc to reduce the current to the desired value. The highest open circuit voltage at which the required welding can be maintained is recommended. Data for electric welding are given in Table VIII.

The physical properties of welds on low-carbon sheet range from 35,000 per sq. in. with bare electrodes to 65,000 lb. per sq. in. with shielded arc electrodes. Elongation of welded sheet using bare electrodes seldom exceeds seven per cent in 2 in., whereas with shielded-arc high-speed electrodes the elongation may be as high as 25 per cent in 2 in.

SPOT WELDING

Practically all rolled or drawn sheets can be successfully spot welded, except tin plate, which deteriorates rapidly after welding. Low-carbon sheet steel, when clean, can be spot-welded with one current impulse; however, should the sheet be scaly, rusty, or heavily coated, a second impulse may be required without releasing the pressure at the die point.

Spot welds in low-carbon sheet steel may be separated by at least the diameter of the spot or point. However, wider separation is recommended because when spaced so close, the spot already made steals part of the current from the next spot attempted, thus causing bad welds. Whenever possible, spots should be placed from $\frac{3}{4}$ in. to 1 in. apart on centers on light and medium gage stock. Data pertinent to spot welding are given in Tables IX and X.

Table IX—PRESSURES USED IN SPOT WELDERS

Diameters, in.		Area of spot,	Sheet thickness,	Allowable load, lb. per spot	
Die point	Welded spot	sq. in.	in.	Dynamic*	Static**
1/8	0.10	0.0078	0.03	31	70
1/4	0.15	0.0178	0.05	71	158
3/8	0.25	0.049	0.08	196	441
1/2	0.35	0.096	0.12	384	864

* Based on 4000 lb. per sq. in.
** Based on 9000 lb. per sq. in.

Table X—WELDING CAPACITY OF SPOT WELDERS *

Sheet gage No.	Electrode diameter, in.	Horn diameter, in.	Capacity, Kva
30–18	7/8	1 3/4	7 1/2
30–16	7/8	1 3/4	10
26–14	1	2	15
26–12	1	2 1/4	20
24–11	1 1/4	2 1/2	30
22–10	1 1/4	2 1/2	40
20– 8	1 1/4	2 3/4	50
20– 6	1 1/4	2 3/4	60
20– 5	1 1/4	2 3/4	75
18– 4	1 1/4	3	100
18– 2	1 1/2	3	125
16– 1	1 1/2	3	150

* With 12-in. throat depth; welding two pieces of stock.

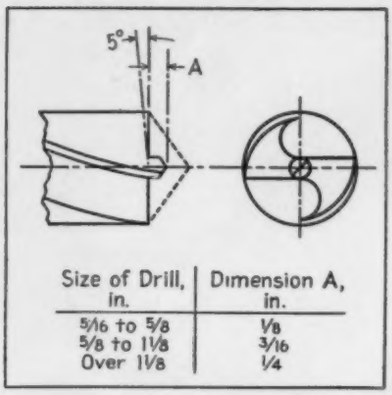
NOTE: The values in this table are conservative, and heavier work can be done on each rated welder when necessary.

COLD-WORKING AND MACHINING

The cold-working of sheet steel requires the use of powerful machines to change the shape, contour or cross-section of the initial shape. It involves mechanical and hydraulic presses for stamping, drawing, bending, and flanging; also equipment for rolling, knurling, curling, seaming, profiling and shearing.

Cold-working causes cumulative strain-hardening with a progressively increasing yield point. After severe strain-hardening in one or a series of operations, the metal must be annealed before further cold-working can be done. If the design of the piece provides for an intermediate annealing operation, the critical range of 1,290 to 1,650 F. should be avoided because grain growth and breakage may occur in the next drawing operation. Annealing temperatures between 900 and 1,000 F. may overcome these difficulties. If not, annealing temperatures not less than 1,650 F. should produce a satisfactory structure.

Cold-rolled sheet steel is recommended for drawing operations.



Size of Drill, in.	Dimension A, in.
5/16 to 5/8	1/8
5/8 to 1 1/8	3/16
Over 1 1/8	1/4

Drills with included point angles of 135–160 deg. have less tendency to cause burrs when drilling sheet steel. Pilot-pointed drills here shown, produce holes that are not out-of-round

Double bends and bends across the grain can be made with specially tempered sheet as noted in Table V.

When there are two right-angles formed at right angles to each other, they should be laid out as near to 45 deg. to the grain as possible. Avoid having forms at an angle of less than 30 deg. to the grain. For parts with low-production quotas, the form of the part instead of the die can be favored in layout and design; the stock waste, although large on each piece, is small compared to the expense of a very costly tool. The reverse holds true for parts made on a high-production basis.

Deep-drawing sheet steels are susceptible to fluting and the development of stretcher strains. Such difficulties can be reduced and in some cases eliminated by roller leveling prior to forming.

The common single-action press may be fitted for the easier drawing operations by adding spring or rubber-pressure attachments, or by using pneumatic die cushions. For more severe draws, shallow stretchings, and for power economy, double-action presses should be used. Triple-action presses permit combined drawing and redrawing at one handling.

In drawing rectangular shells, the

Table XI—FORMULAS USED FOR COLD-WORKING CARBON SHEET STEEL

Flat rolling:	
Area of rolls	$A = w\sqrt{R\,(t_1 - t)\,2}$
Rolling pressure	$P = 3.2\,S_r\,A$
Bending:	
Length of radii, Fig. A	$L = (r+0.4t)\,(2\,\pi\,B^2/360)$
Length of stock, Fig. A	$L_1 = X+L_1+Y+L_2+Z$
Punch pressure, V-bends, Fig. B*	$P = (C\,S_u\,w\,t^2)/V$
Punch pressure, U-bends, Fig. C	$P = \frac{2}{3}\,S_u\,w\,t\,(1+t/V)$
Bottom-pad pressure, U-bends, Fig. C	$P_1 = \frac{2}{3}\,(S_u\,w\,t^2)/V$
Pressure in roll bending	$P = 12d\,E\,w\,t_3$
Blanking:	
Blanking pressure, flat tools	$P = l_s\,t\,S_s$
Blanking pressure, sheared tools, Fig. D	$P = (l_s\,t^2\,S_s\,p)/s$
Blank diameters for drawing shells	$D = \sqrt{D_m^2 + D_m h}$
Work done in blanking	$W_b = (P\,t\,p)/2000$
Drawing:	
Limit drawing pressure, rectangular shell**	$P_{max} = l_s\,t\,S_u$
Limit drawing pressure, round shell**	$P_{max} = \pi\,D_m\,t\,S_u$
Pressure for shallow draws	$P = \pi\,D_m\,t\,S_u\,[(D/D_m) - 1.3]$
Stretching pressures, Fig. E	$P = l_p\,S_u \sin a$

* This formula makes no allowance for spring back; increase the pressure to minimize spring back.

** Loads obtained with these formulas are those necessary to punch the bottom out of the shell.

Nomenclature

P = downward pressure, lb.; P_1 = upward pressure of punch pad, lb.; A = roll contact area, sq. in.; R = radius of roll, in.; w = width of sheet, in.; t = thickness of sheet after flat rolling, in.; t_1 = thickness of sheet before rolling, in.; S_r = yield strength of sheet, lb. per sq. in.; S_u = ultimate strength of sheet, lb. per sq. in.; S_s = shear strength of sheet, lb. per sq. in.; L = mean length of a given bend.; L_1 = total length of sheet for making bends, in.; r = radius of bend, in.; B = angle of bend, deg.; X, Y, Z = length of tangents adjacent to bends, in.; V = width of die for making bends, in.; C = constant for calculating bending pressures — $C = 1.33$ when $V = 8t$, $= 1.24t$ when $V = 12t = 1.2$ when $V = 16t$; E = modulus of elasticity, lb. per sq. in.; d = deflection of rolls in bending, in.; l_d = length of periphery of rectangular drawn work, in.; l_s = length of periphery of punch for shear cuts = length of four sides in rectangular work = $\pi \times$ diameter of punch for round work, in.; l_p = length of periphery of punch for stretching, in.; s = shear of punching tool, in., see Fig. D; p = shear penetration, per cent = 38 per cent for low-carbon steel; D = blank diameter, in.; D_m = mean diameter of drawn shell, in.; W_b = work done in blanking, inch-tons; W_d = work done in drawing operations, inch-tons; h = height of drawn shell, in.; a = angle stretching punch makes with die, deg., see Fig. E.

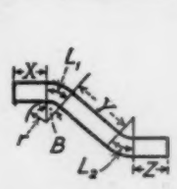


FIG. A

FIG. B

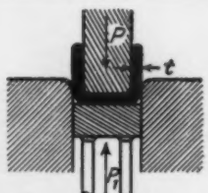


FIG. C

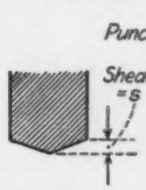


FIG. D

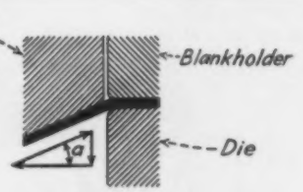
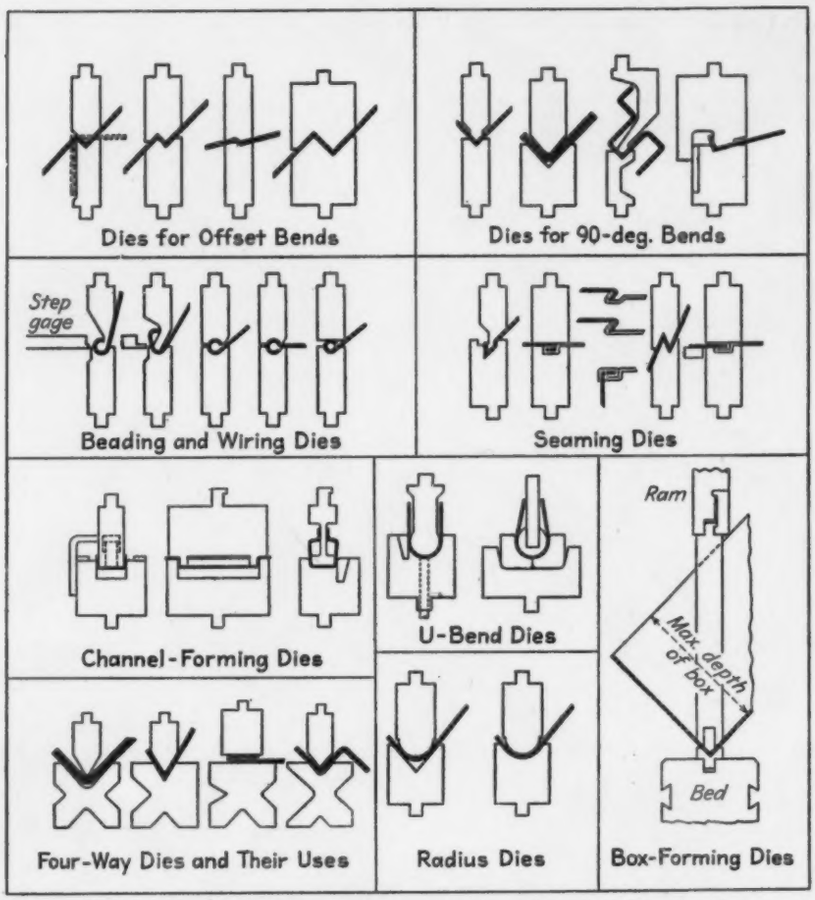


FIG. E



These typical single-purpose and combination dies are the simplest and most economical to build and use for bending sheet metal

limit depth per operation is about four to six times the corner radius, because of the distribution of surplus metal from the corner area into the adjacent wall area. The drawing pressure is relatively lower than for round work. The allowance for blank holding may run as high as 100 per cent of the drawing pressure, depending on the severity of the draw.

In stretching shallow shapes, the metal may be gripped tightly around the edge. The blank-holding pressure is two or three times the relatively low-drawing pressure.

The pressure required to hold the blank flat while deep-drawing round work varies from zero for relatively thick blanks, up to a third or a half of the drawing pressure. When the blank-holding pressure, exceeds a third of the drawing pressure, it is best to use draw beads to permit the blank-holding pressure to be decreased.

Mechanical grip on the edges of blanks, as obtained in toggle and cam presses is, for practical purposes, positive and non-yielding. It is desirable for domed and tapered shallow shapes and for shallow stretching, especially where draw beads must be stamped to help grip the metal.

Rubber bumper pressures may be approximated at 10 lb. per sq. in. of area per one per cent of compression. More uniform pressures and more convenient control of pressures are obtained with die cushions. Pneumatic die cushions may be selected on a basis of 100 lb. per sq. in. of piston area, maximum; hydro-pneumatic cushions for drawing purposes can be selected on a basis of about 500 lb. per sq. in.

The total per cent reduction accomplished between annealing operations, whether in one or more operations, should be kept within the percentage of reduction in area established by tensile tests of the properly annealed material.

Formulas for calculating various factors in cold-forming operations on sheet steel are listed in Table XI.

The steel used in forming dies depends upon two factors; the length of run expected from the die, and whether the die is of simple or intricate design. For example, where short runs are anticipated, a carbon-vanadium water-hardening tool steel may be used. For dies of intricate design or in those intended for long runs, a manganese oil-hardening steel can be used. Die steel data are given in Table XII.

Cemented-carbide die inserts are being used successfully for some drawing operations. For example in making ferrules for stove pipe dampers, using cold-rolled strip steel 0.02 in. thick to form a cup $\frac{3}{4}$ in. outside diameter by $\frac{1}{4}$ in. high, a cemented-carbide die produced between 12,000,000 and 14,000,000 pieces per refinish of the die insert. This approximates four years' service. These parts were produced with little or no trouble from galling.

BENDING AND SHEARING

The most common operating speeds of bending presses is 20 to 30 strokes per minute, although presses are built with two-speed arrangements, the lower of which is usually ten strokes per minute and is used to avoid reverse bends when working long sheets. Reverse bends are caused by whipping of sheets when the work is done too fast. High speeds up to 90 strokes per min. can be used for punching operations.

A great variety of bends may be formed as shown in one of the illustrations.

Special steel dies can be used for making bends with sharp corners, or where considerable tonnages are required, or where there are a sufficient number of pieces to warrant the cost. However, a single set of one-purpose dies is costly. A one-die set-up with a variety of inserts will keep down the cost.

Large sheets are cut to shape in squaring or "gate" shears, which are essentially a single-purpose modification of the gap-frame, double-crank power press, arranged with a set of shear blades, a hold down to clamp the metal while cutting it, and a set of gages to assist in locating the cut. Circle-cutting shears, rotary splitting shears, and gang-splitting machines for two or more parallel cuts, exert working pressure localized on a small area at the point or line of contact between rolls and the work; since the work is progressive, a continuous and more or less uniform supply of power must be maintained.

Beading, flanging, knurling, curling, and double seaming, as well as other rotary cold-forming operations are performed on a variety of machines from simple parallel-shafts, hand-served types, to multiple-spindle, chute-feed and high-speed production automatics.

DRAWING COMPOUNDS

The better drawing compounds consist of a concentrated-base product which is capable of high dilution with water or oil or both. Saponifiable oils and fats, such as palm oil, seed oils, including cottonseed and rapeseed, animal oils and fats, such as beef and mutton tallow and lard oil, together with fish oils, sperm oil are all used to formulate the base. They are either saponified with caustic soda or potash, or are made into an emulsion.

Saponifiable materials are sometimes added to the make-up of a compound in a sulphonated form, such as sulphonated castor, sulphonated tallow or sulphonated sperm. Mineral oils may be added to the compound to provide lubricity. These oils are sometimes chlorinated in order to build up their extreme pressure film strength.

Pigments, such as whiting lithopone, talc, and soapstone, are added to the compound to act as a mechanical "spacer" or separator and to prevent scoring and seizing where the die pressure on the work piece is high and which tends to break through the compound's lubricating film. The pigment helps to prevent seizure.

Blanking and punching requires no expensive lubricant. Straight mineral oils or soluble oils, highly diluted, are usually satisfactory for such operations.

Forming operations, where the sheet is merely bent or stretched slightly, requires no lubricant.

Drawing operations which are more severe require carefully compounded products. Depending upon the finishing operations to follow drawing, the compound may be made up of saponifiable material, mineral oil, pigment and water.

When a degreaser is used to clean the stampings, the soap content is kept to a minimum. Pigments are also held to a small percentage or eliminated entirely due to sludge accumulation in the degreaser tank.

Work to be vitreous enameled must be drawn with a non-pigmented compound, keeping the unsaponifiable content very low. Inclusion of the inert material of the compound in the "pores" of the steel during the flow of metal in the die operation, results in defective enamelware after the parts are baked under high heat.

On multiple-station, fast-production working of low carbon steel a drawing oil is usually used. This may be either emulsifiable or non-emulsifiable. Chlorinated paraffine, various grades of straight mineral oil, sulphurized oils, saponifiable oils are usually included in this base product.

In determining the type of drawing compound needed to smooth the flow of steel, it is necessary to learn the type of metal to be worked, the kind of dies used, the production speed, the method of cleaning and type of finishing to follow the operation, before the proper type of drawing compound may be recommended for any particular job. Although any one of several types of compounds might work in the drawing operation itself, the cost of cleaning and finishing might prove to be too high where certain compounds have been used.

DRILLING AND TAPPING

When drilling $\frac{1}{16}$ to $\frac{8}{16}$ in. holes in carbon sheet steel, high-speed drills, designed with a shorter twist cut and heavier web than used on a regular drill, are recommended to avoid breakage. The included point angle for small drills can be 118 deg., with 10- to 12-deg. lip clearance.

When drilling large holes, included point angles of 135–160 deg. are recommended to prevent the drill from pushing through the sheet and causing a burr on the back side of the sheet. Drills with large point angles cannot always be started easily on a flat surface, and this condition sometimes makes it advisable to use a smaller point angle, even though a larger burr is produced. Some drill manufacturers recommend thinning the web on large drills for sheet metal work, since this reduces the pressure needed to force the drill through the work.

"Hogging in" when breaking through a hole is caused by the screw action of the right-hand spiral pulling the drill through the material. In order to curtail this tendency, the spiral angle at the cutting edge of the drill can be reduced. This is accomplished by grinding a flat along the cutting edge at the drill point, thus reducing the rake angle.

It is often difficult to drill a round hole in sheet steel. This can be partially or entirely eliminated by using what is known as a "modified" spur or pilot point, that is, a drill with the spur in the center of the tool, similar to a wood bit, but without lip at the periphery. When grinding such a drill, the spur should be exactly in the center. With such drills, the web

Table XII—COMPOSITION AND HEAT-TREATMENT OF TOOLS FOR COLD WORKING CARBON STEEL †

Steel No.	Tool	Elements, per cent C	Mn	Si	W	Cr	V	Mo
1	Dies and punches	0.84	....	....	.....	.....	.....	.....
2	Dies and punches	1.10	....	....	.....	.....	Opt.	.....
3	Dies and punches*	0.90	1.10	....	0.50	0.50	0.20opt.	.....
4	Dies and punches*	0.90	1.60	....	.....	.....	.....	.....
5	Dies and punches*	1.15	0.30	....	1.60	0.50	0.20	.....
6	Punches	0.50	....	....	2.00	1.25	0.25	.....
7	Punches	0.55	0.80	2.00	.....	0.50max.	0.25max.	0.30max.
8	Punches	0.50	0.40	1.00	.....	.....	.....	0.50
9	Shears, dies and punches	0.70	....	....	18.00	4.00	1.00	.....
10	Shears, dies and punches	2.10	....	....	.....	12.00	.....	.....
11	Shears, dies and punches	1.50	....	....	.....	12.00	.....	0.75

HEAT-TREATMENT

Steel No.	Preheat temp. F.	Rate of heating for hardening	Hardening temp. F.	Time at heat, min.	Quench medium	Temper temp. F.
1	.....	Slow	1400–1450	10–30	B or W	350–550
2	.....	Slow	1400–1475	10–30	B of W	350–550
3	1200	Very slow	1450–1500	Note A	O	325–500
4	1200	Very slow	1400–1475	Note B	O	325–500
5	1300	Very slow	1575–1625	Note A	O	350–550
6	.....	Slow to 1400	1650–1750	10–30	O	500–650
7	.....	Slow	1575–1675	10–30	B or W	350–700
8	.....	Slow	1525–1575	10–30	B or W	350–700
9**	1450–1600	Rapid from preheat	2200–2300	Note B	A or O	1050–1200
10	1500	Very slow	1800–1875	15–45	A(still)	400–1000
11	1500	Very slow	1700–1800	15–45	O	400–1000

Only type analyses are given.

Note A: To obtain maximum hardness hold at heat up to ½ hr. For minimum change in dimensions, do not hold at heat.

Note B: Do not soak.

* Recommended for non-shrinkable tools.

** May be pack hardened at 1950–2200 F. and tempered at 1050–1200 F., and quenched in oil or air; also, pack hardened at 1850–2000 F., tempered at 500–900 F., and oil quenched. In both cases, do not hold at hardening temperature any longer than is necessary to assure that the die has reached the desired dimensions.

Quenching media: A = air, B = brine, W = water, O = oil.

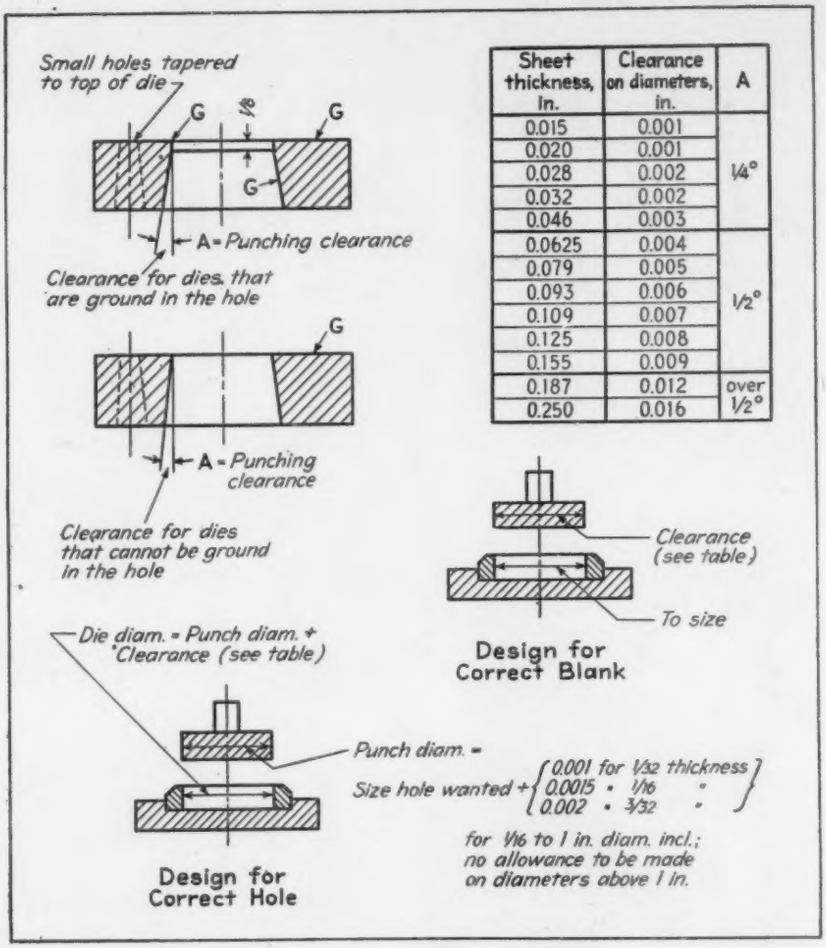
at the point should be thinned to about half the regular thickness. Another method for drilling round holes and elimination burrs is the use of a combination drill having two diameters. The large diameter tends to remove any burr which the small diameter may cause, without causing any of its own. The difference in diameters need to be only enough to clean up the burr or any out-of-round condition.

Success of drilling sheet metal in general is dependent upon solid support. Clamps should be used close to where the hole is to be drilled.

Drilling speeds in low-carbon sheet-steel range from 60 to 100 surface ft. per min. Soluble oil is the most generally recommended lubricant.

Reaming of holes in sheet steel is best performed at 60 to 80 surface ft. per min. Feeds for machine reaming of sheets in stacks should be two or three times the corresponding drill speed. For reamers smaller than $\frac{1}{8}$ in., machine feeds should be 0.002–0.004 in. per revolution for $\frac{1}{8}$- to $\frac{1}{4}$-in. reamers the feed should be 0.004–0.008 in. per revolution. For larger reamers use feeds up to 0.003 in. per revolution. Many holes in sheet steel are reamed with pneumatic and electric tools held by the operator, in which case the reamer should be advanced slowly to prevent reamer wear and scoring of the hole.

For threading through holes in sheet steel, high-speed ground-thread spiral pointed taps will produce satisfactory results. Recommended speeds are 30–40 surface ft. per min., using sulphur base oil as a lubricant.


Small holes tapered to top of die
G
G
G
A = Punching clearance
Clearance for dies that are ground in the hole
G
A = Punching clearance
Clearance for dies that cannot be ground in the hole
Clearance (see table)
To size
Design for Correct Blank
Die diam. = Punch diam. + Clearance (see table)
Punch diam. =
Size hole wanted +
0.001 for 1/32 thickness
0.0015 " 1/16 "
0.002 " 3/32 "
for 1/16 to 1 in. diam. incl.; no allowance to be made on diameters above 1 in.
Design for Correct Hole

Sheet thickness, In.	Clearance on diameters, in.	A
0.015	0.001	1/4°
0.020	0.001	
0.028	0.002	
0.032	0.002	
0.046	0.003	
0.0625	0.004	1/2°
0.079	0.005	
0.093	0.006	
0.109	0.007	
0.125	0.008	
0.155	0.009	
0.187	0.012	over 1/2°
0.250	0.016	

Rough and torn edges can be avoided when punching or blanking thin sheet by adopting precise clearances for the punch and die. These clearances are used most commonly

SAWING

Carbon sheet steel is easily sawed in both single and multiple sheets on metal band saws. When stacking this material for multiple sawing, height is usually limited to 8 in. There are several methods of holding the sheets together. One is to braze or weld the pieces together. Another is to hold the pieces to a $\frac{1}{4}$-in. plate, using studs screwed into tapped holes in the plate.

When sawing single or stacked sheets, longer saw life can be expected from cold-rolled sheets than from hot-rolled sheets. For 30–16 gage sheet, use a 32-pitch, wave-set saw at 500-1,500 surface ft. per min. For 16–8 gage sheet, use 24-pitch raker- or wave-set saws running at 300–500 surface ft. per min. For 8 gage to 1 in. stock, use 18-pitch raker-set saws at 250-300 surface ft. per min. Carbon sheet steel is sawed without coolant or lubricant of any kind, the heat generated being dissipated as the saw travels around the carrier wheels.

The width of the bandsaw will be determined by the contour to be sawed. Narrow bandsaws will not withstand as high tooth pressures as wide saws; consequently, the cutting time is somewhat higher. All saws for cutting carbon sheet steel should have a hard temper.

Laminated sheet steel can be cut with circular saws, providing a fine pitch blade is used. In general, the pitch of the blade should not exceed the thickness of the metal being cut.

Although machining of sheet steel is not practiced extensively, some single sheets in the thicker sizes, as well as laminated thin sheets can be either bored or the edges cut parallel with or perpendicular to the length of the sheet. Round-nose tools are most often used, especially with laminated sheets, since they have less tendency to "hog in." Width of the tools seldom exceeds $\frac{5}{8}$ in., with narrower sizes being preferred. The nose radius for $\frac{1}{2}$-in. tools should be 0.072 in., while that for $\frac{5}{8}$-in. tools should be 0.026 in. Tools of high-speed steel predominate for cutting low-carbon sheet steel.

Recommended angles for roughing tools are: back rake 6–10 deg.; side rake, 14–22 deg.; side relief, 5–9 deg.; and end relief, 5–9 deg. For finishing tools use 14–22 back rake; 5–9 deg. end relief, and no side rake or side relief.

Rough cutting thin sheets is not recommended unless they are laminated in tightly compressed stacks. Even then, the roughing cut is likely to leave tool marks and result in tearing the edges of the sheets. Hence, light cuts and fine feeds are most frequently used. As a rule, cuts do not exceed $\frac{1}{32}$ in., while feeds are held below 0.002 in.

Lubricants used are sulphurized mineral oil, 40-to-1 soluble oil, and water with $1\frac{1}{2}$ per cent borax or soda.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Heat-Treating Troubles and Their Correction

BY R. B. SEGER, SHOP SUPERINTENDENT, THE LINDBERG STEEL TREATING COMPANY

WHEN A PIECE of steel is to be heat-treated, there are precautions which the heat-treater can observe to produce the best job. Elements of design, removal of mill scale, surface conditions, and similar factors are beyond his control unless consulted before the part is made. Incidentally, for best results the toolmaker should never hesitate to call upon the heat-treater for advice on heating data.

Heating rate, temperature control, quenching media and method, furnace atmosphere, and tempering procedure are the tools which the heat-treater has to use. To insure proper control of these tools, it is essential that the composition of the steel be accurately known. Hardening on the bases of a spark test is foolhardy at best, and may result in considerable expense and valuable lost time.

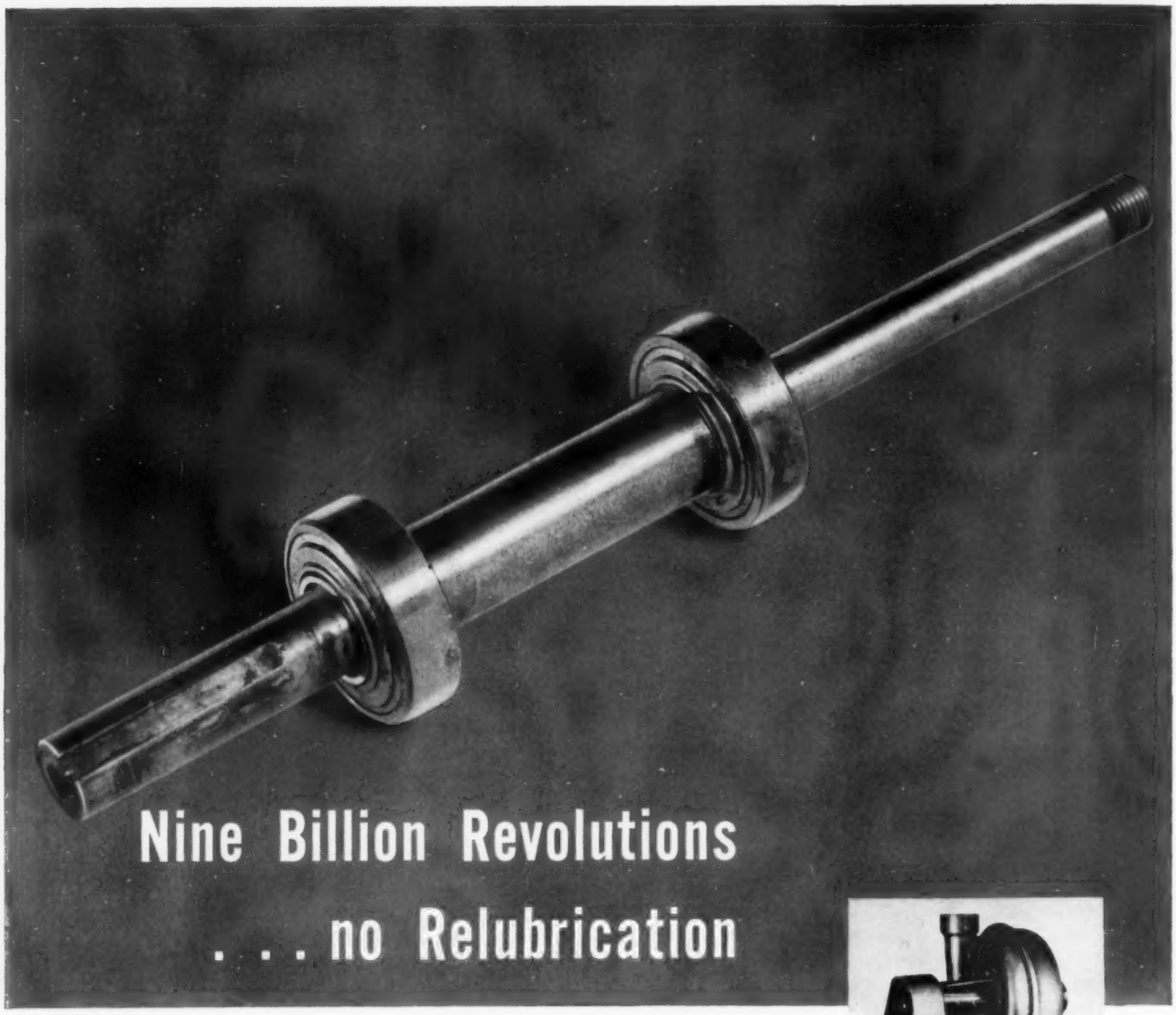
The more common defects occurring during heat treatment are: (1) cracking, (2) warpage, (3) soft spots, (4) size change, and (5) spalling. A review of the following tabulations will show that the toolmaker may do much to aid the heat-treater in producing a perfect article.

CRACKING

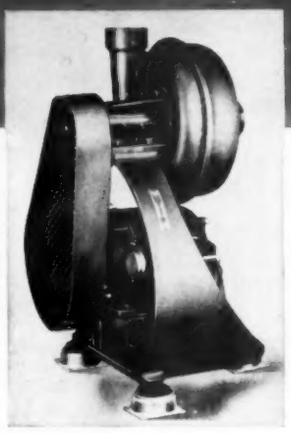
CAUSE	METHODS OF CORRECTION
Design	Always allow as liberal a fillet as possible in corners. The more generous the fillet the less chance of a corner being a starting point for failure. Avoid the junction of thin and heavy sections—two pieces are better than one if the sections vary in mass.
Underheating, non-uniform, and too rapid heating	Use a double preheat of 600 F. and 1200 F. on all steels with the exception of those which harden at the higher temperatures such as hot work, high-speed and high carbon-chrome steel, where it is advisable to preheat at 600 F., 1200 F., and 1550-1600 F. before entering the high heat. Never place a cold piece of steel in a high-heat furnace.
Non-uniform quench	To insure a uniform quench place extra holes in large sections and plug the holes with fireclay or asbestos wherever possible in thin portions. The quench may be also retarded on thin sections by the use of an asbestos jacket or by coating with any of the pastes which are available.
Grain growth	There is great danger of cracking when steels are overheated due to the resultant grain growth. If steels are overheated it is necessary to cool in air to room temperature and then to proceed with the correct hardening treatment.
Soft Spots	Scale or gas pockets on the surface will cause soft spots which will have a different cooling action from the surrounding hardening material. Actually, the hardened material will shrink away from the soft material causing flaking at the surface.
Failure to relieve hardening strains	Place material in tempering furnace immediately after hardening while the piece is still 200-300 F. warm. Give a long enough draw so that the structure is completely homogenized. Short, rushed draws promote cracking, especially during the grinding operations.
Cold deformation	On hobbing steels, cracking will generally occur if the annealing operation is omitted prior to hardening.

WARPAGE (SHAPE CHANGE)

CAUSE	METHODS OF CORRECTION
Mill scale	Remove sufficient surface material from all sides of the piece to be treated as recommended by the steel manufacturers. When mill scale (bar stock) is allowed to remain on one surface, the heating and cooling rates will differ from the others, causing warpage.
Design	Avoid the combination of light and heavy sections. If a heavy section is required, reduce its mass by drilling a few well placed holes so that the cooling and heating rates of the sections will be somewhat similar.
Surface condition	Often the hardener will receive parts that are rough-machined on one surface and ground on another; this produces an unbalanced condition in heating and in subsequent cooling, causing warpage. It is advisable to have all surfaces finished alike.
Gas pockets	Gas liberated from the quench if adhering to portions of the part will cause warpage. This warpage can be minimized by correctly agitating the sample or by flush quenching the part; also, on parts with sharp recesses the pieces should be quenched



Nine Billion Revolutions . . . no Relubrication



WHEN they mounted these New Departure Self-Sealed ball bearings on their blower shaft for testing, the Allen-Billmyre Company of South Norwalk, Conn., were looking for bearings that would give them dependable, long-life operation *minus* the cost and bother of frequent lubrication.

More than 15,000 hours, 24 hours a day, at nearly 10,000 r.p.m., or the equivalent of over 6 years normal operation, with the bearings still going strong, demonstrated beyond doubt that they had found what they wanted in these pioneer Lubricated-for-Life bearings.

Remember: When it's a matter of bearings, New Departure engineers are always "at your service." Nothing rolls like a ball.

"Sealed!" is the title of an intensely interesting booklet describing the development and many uses of the self-sealed bearing pioneered by New Departure. Booklet D-6 free upon request. New Departure, Bristol, Conn.

NEW DEPARTURE

PIONEER OF THE SELF-SEALED BEARING

2925

Heat-Treating Troubles and Their Correction

	so that the gas is not trapped next to the part. If necessary, holes can be drilled to allow the escape of any trapped gas.
Overheating	If work is inadvertently overheated, allow the piece to cool in air to room temperature before proceeding; then reheat to the proper temperature for quenching.
Machining Strains	A stress anneal after the rough machining operation is very beneficial in reducing warpage.

SOFT SPOTS

Cause	Methods of Correction
Quenching media	Tap water should not be used for quenching unless used under pressure as during a flush quench where the water is continually passing over the surface. Tap water contains a large amount of dissolved gas which is liberated on contact with hot metal thus preventing rapid cooling. The addition of 5 to 10 per cent of salt will reduce the amount of dissolved gases and help to eliminate soft spots.
Bath temperature	When the temperature of the quenching bath is too hot, the cooling rate may be retarded sufficiently so that some steels will have soft spots and very often fail to harden.
Insufficient agitation	Agitation must always be rapid enough to insure the elimination of gas pockets. This may be done by flush quenching or by moving the part rapidly through the media.
Scale	Scale on the surface retards the quenching action and should be minimized by use of the proper atmosphere.
Tongs	If the grasping portion of the tongs covers too great an area that section will cool to below the critical temperature resulting in failure to harden. Have proper tongs available to handle various classes of work.
Dirty compound	Foreign material, such as fireclay and scale, in the carburizing compound will cause soft spots when in contact with the work by inhibiting the carburizing action. Never allow parts to be in contact with one another in the pack as soft spots will result at the point of contact.

SIZE CHANGE (Growth or Shrinkage)*

Cause	Methods of Correction
Heating	On steels which harden all the way through, overheating above the recommended temperature will cause expansion of the parts and heating below the recommended temperature will cause shrinkage. Be certain of the correct hardening temperature.
Depth of hardness	Steels which are of the surface-hardening variety (water hardening) or case-hardening steels tend to shrink on hardening. The higher alloyed steels which harden all the way through, such as oil-hardening and air-hardening types, usually tend to grow. These points should be considered when selecting the steel.
Excessive scaling	With the use of improper furnace atmospheres scaling may become so excessive as to cause size change due to the material lost. Determine the right atmosphere for your job. When an atmosphere furnace is not available, use an oxidizing atmosphere for carbon and oil-hardening steels, and a reducing atmosphere for high-speed and stainless steels.
Quenching	If cooling rates of outer and inner surfaces vary excessively, shrinkage will generally be found to occur. Flush quenching will tend to equalize cooling rates.
Cold-drawn stock	When heated, cold-drawn stock will expand due to the release of the drawing strains. An anneal before machining will correct this.
Nitriding	There is always a definite growth in size during the nitriding operation and this should be allowed for.

SPALLING

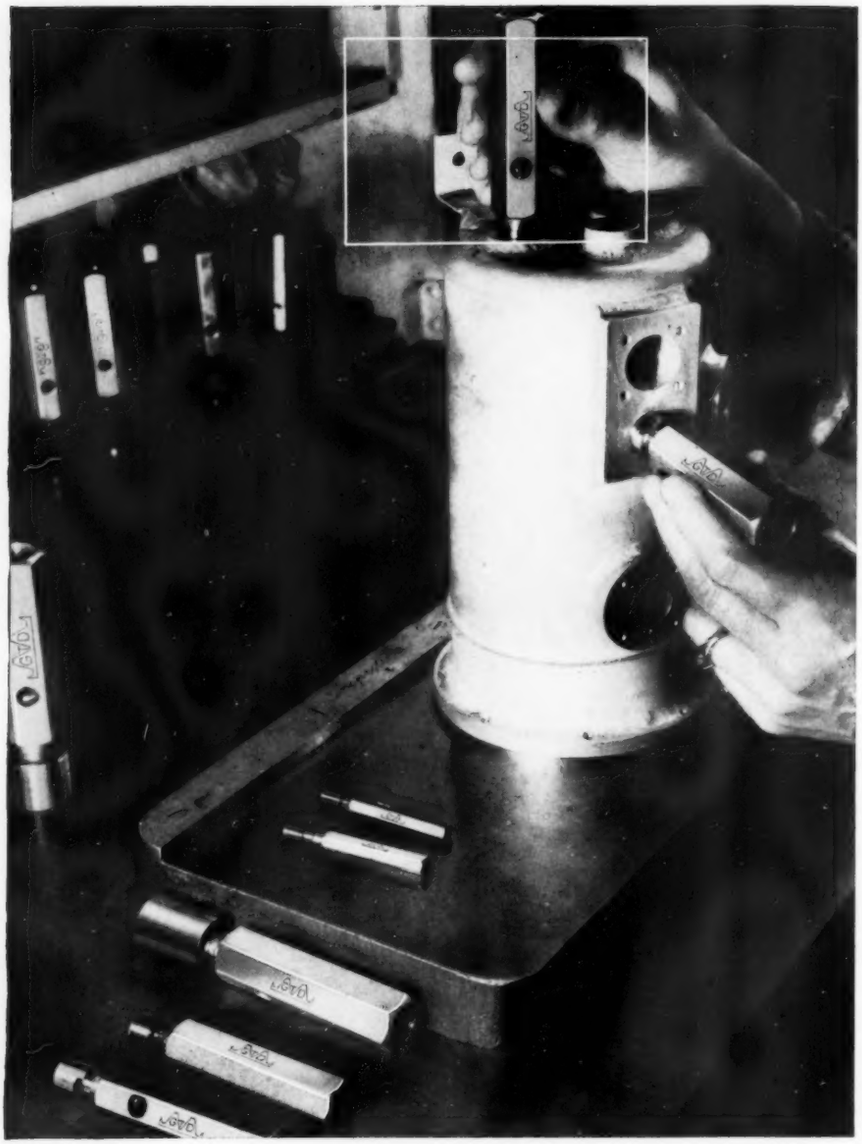
Cause	Methods of Correction
Carbide network	Carbide network in the grain boundaries of carburized steels causes spalling and can be eliminated by quenching from the carburizing box or by reheating above the critical of the core and quenching.
Grinding	Improper use of the grinding wheel can cause minute cracks which in turn tend to spall in service.

* Size change is often confused with warpage although referring directly to dimensional changes. Warpage implies twisting and bending.

Plenty of gages means faster, more accurate, less expensive production.

Gyro Pilots

CHECKED WITH GTD GREENFIELD GAGES



Gyro pilots are extremely intricate and every part must be manufactured with unusual care and precision.

In this picture of the oil sump assembly can be seen 14 different "GTD Greenfield" Gages—reasons why this part will be *right*.

A long-time record for accurate manufacture, the development of special methods for giving gages long life (such as our "Rex" surface treatment) and our experienced gage engineering service make "GTD Greenfield" Gages especially interesting to any manufacturer who wants to make the most profitable use of his gage investment. A study of your needs will be made without obligation.

The "G.T.D. Greenfield" line of gages include plain and threaded, plug and ring gages; plain and thread limit-snap gages, and a large number of special types. All can be furnished with "*Greenfield's*" exclusive "Rex" Finish for extra long life, if required.

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass.

Detroit Plant: 2102 West Fort St. Warehouses in New York, Chicago, Los Angeles and San Francisco. In Canada: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ont.

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

FULL SPEED AHEAD

UPON ONE POINT the American people agree. The United States should build military and naval establishments so strong that no other power dare attack us. The full value of such strength was not realized until France fell so swiftly in June.

That high purpose puts on American industry a huge and grave responsibility. It must literally build a munitions industry from the ground up, and do it in half the time it took either Germany or England.

It sounds like an impossible task, but it can be done, and actually is now on the road to accomplishment. Sooner or later, however, the program will bog down unless the three parties involved cooperate without stint. Those three parties are industry, labor and the government.

None of the three can afford to hold back. Two of the three must not gang up on the other. No one must be diverted from that main task ahead, no matter what the cost.

Industry is doing its part. It has sidetracked its normal business in behalf of the national interest. It has gone ahead, before enabling legislation was enacted by Congress, and invested tens of millions of dollars in new plant facilities and in new equipment.

It has sacrificed all other factors on behalf of speed. To attain speed it often is necessary to employ expensive methods, to utilize whatever is usable and not wait for an ideal set-up. Production becomes costly. Men must be trained. Efficiency of the individual workman drops; his productivity is less. But that is to be expected, and industry does it willingly.

Let's take a look at labor and the government. Labor is getting high rates. Good skilled and semi-skilled men are not easy to find. In many plants men are needed extra hours. It is no time for unions to kick up a fuss. That is, unless an employer has taken unfair advantage of the situation, and it is a reasonable conclusion that few have. They are too busy getting out production and tooling up for new jobs to sit up nights scheming how to do labor out of some of its rights (even if they were thus inclined).

So the latest "informal opinion" of Attorney-General Jackson strikes a rasping note. He said, in effect, that any company which violated the Wagner Act, as interpreted by NLRB and prior to affirmation by the courts, should not be awarded defense contracts.

In view of John L. Lewis' repeated unsuccessful efforts to get Congress to pass a law saying that no violator of the Wagner Act may be eligible for governmennt work, we suspect that Mr. Jackson was attempting to carry the ball which Mr. Lewis previously had fumbled.

And that just doesn't sit well at all. We don't believe the public will like the government's being up to some shenanigans on behalf of a partisan group when it should be directing all its energies toward the main objective—arming the nation. For what the American people want now is results. "Damn the torpedoes; full speed ahead."

Burnham Finney

GAGING BUSINESS

Entire machine tool output for 1941, which should be in excess of $500,000,000, will be required by the defense program. Steel may be ample. U. S. asks aviation industry to work 24-hour day

Machine Tools—There has been no respite in the unprecedented demand for machine tools for the armament program. The situation is aided a bit by the passage of legislation permitting the Federal Government to take over machines now at seaboard which cannot be shipped to foreign buyers because export licenses have been refused. However, that does not relieve the pressure on machine tool builders who, in many cases, have a solid year's backlog on hand. The defense program itself plus British needs will take all their output in 1941, which should be in excess of $500,000,000. While some plants continue to run double shifts on a 50 to 55 hour week, others are on three eight-hour shifts. Priorities on machine tools are being granted aircraft engine builders over ordnance and other Army requirements. Some confusion is resulting, however, from too many defense contracts being given a preferential rating instead of being classified more carefully in relation to delivery time. Britain is continuing to secure large shipments of machine tools, most of the machines going to England rather than to Canada and Australia. Contrary to general impression, some machine tools not essential in the defense program are still going out to Russia. Customers making peacetime products are finding it almost impossible to secure machine tools at this time. For this reason it is a pretty well accepted fact that no new automobile models will be offered for 1942.

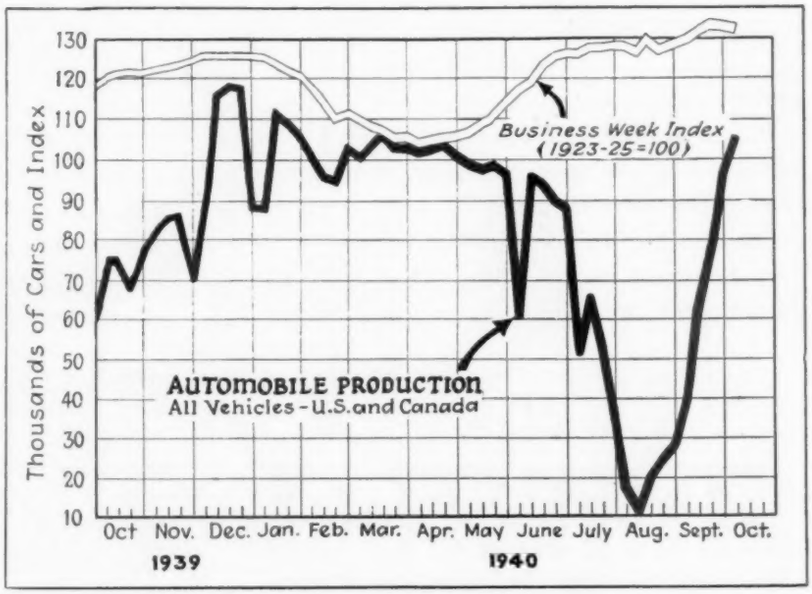
Railway Equipment—About 33,500 freight cars have been ordered this year, or approximately the same number as in the first nine months of 1939. Locomotive bookings are well ahead of those a year ago. Substantial defense contracts plus good equipment business have put manufacturers in a position where they are beginning to worry about deliveries and getting steel. Northern Pacific has ordered 20 locomotives and the Wheeling & Lake Erie some 1,800 freight cars. Baltimore & Ohio will buy 1,000 cars and will build a like number at its Cumberland, Md., shops.

Farm Equipment—Export sales this year, estimated at upward of $87,000,000, will be the best since 1930. One maker reports English business 50 per cent higher this year than last. Domestic volume will approach the peak year of 1937. Tractor manufacturers are enjoying excellent sales because of good industrial demand on top of an active farm market.

Steel—The steel industry will be able to handle the defense load without much expansion of facilities unless all the tonnage is concentrated in a short period, which appears unlikely. Republic, Carnegie-Illinois and Crucible are among companies adding electric furnace making capacity, which will be needed in producing alloy steels. Biggest demand will be for shell steel. A possible shortage of bar mill capacity is reported, though it may be avoided. Some steel men foresee the necessity soon for voluntary if not compulsory priority on steel deliveries.

Aircraft—Rapid plant expansion has temporarily interfered to some extent with airplane production. For that reason output of 950 planes this month is somewhat behind the planned timetable. By January 1 around 1,250 planes a month will be assembled. Splitting up planes into minor assemblies for few designs instead of many and subcontracting certain branches of the work are aiding greatly in getting out higher production. In September about 2,400 engines were turned out. That figure will be surpassed this month. The War Department has asked all plane makers to work 24 hr. a day wherever feasible. Buick and Studebaker are reported negotiating to build 2,000-hp. radial Wright engines under a licensing arrangement similar to that under which Ford is starting to make Pratt & Whitney engines. Each company is said to be counting on 1,000 engines a month. Bendix Aviation, in addition to acquiring an Atwater Kent factory in Philadelphia, has purchased the long-idle Wayne, Mich., body plant of Graham-Paige and will employ 1,500 men on overflow work on defense contracts.

Munitions—Contracts totaling almost $1,200,000,000 have been placed with private industry by the Ordnance Department of the War Department since the defense program started. For ordnance purposes almost 100 plants must be constructed in various parts of the country at an expenditure of over $1,000,000,000. Over 60 per cent of the money made available by Congress for munitions manufacture has been awarded. Arsenals are on a three-shift basis, though they are having trouble securing enough skilled men, including inspectors. Light tank production is at a rate of 100 units a month. No medium-weight tanks will be manufactured by private companies until about May.



Canadians Make Impressive Progress in War Effort; Aircraft, Steel, Gun Plants Speeded

OTTAWA—Though Canada's war effort will not reach a peak for some months, impressive progress has been made. This is in face of the fact that the British have been extremely slow in placing volume orders for munitions and aircraft in Canada. Not until after the French debacle did things begin to happen rapidly.

The Empire Air Training Program is ahead of schedule. Airdromes to have been completed in 1941 and 1942 are now almost ready, some 2,000 buildings having been erected. The Royal Canadian Air Force today consists of 2,500 officers, 23,000 men and 3,500 civilians. Airplane parts and materials, heretofore bought outside exclusively, are to be made in Canada.

While some semi-official talk is heard about building airplane engines in Canada, government officers are fully aware of the obstacles. A shortage of skilled men exists and it would be impossible at this time to get technical men from the United States and England needed in training an engineering and production force. Canada also recognizes the great technical difficulties in getting such a complicated mechanism as an airplane engine into production within a reasonable length of time. It is believed that it would take 18 to 24 months to set up a plant and have it working properly.

Capacity Steel Production

Canada this year will use its full steel-making capacity of 2,300,000 tons. Because of the heavy demand it has been necessary to enforce priorities, the highest priority being given to plants making shell and munitions. Next in priority rating is steel for building plants for making munitions. Steel for non-war uses has been severely restricted.

Approximately $10,000,000 has been spent in constructing and equipping aircraft plants. Backlogs of plane makers today exceed $100,000,000. In the award of war contracts, as much as possible has been done by competitive bidding.

Plants exclusively for munitions manufacture which must be erected to meet the current emergency are permitted short-time depreciation and write-offs for tax purposes. A government depreciation board determines the peacetime value of a wartime plant, if any, and supervises the rates. In arriving at a basis for excess profits, the government takes an average of the earnings of the four years preceding the war. In the case of a new company the tax is based on the average earnings in that industry. In so-called "lame duck" or depressed industries the basis is a return of 5-10 per cent on the capital invested instead of recent profits. The excess profits tax is a flat 75 per cent. If a company has not earned any excess profits, it still must pay an additional 12 per cent on top of its 18 per cent corporation tax, making a minimum of 30 per cent tax on gross earnings.

Guns Ahead of Schedule

Canada started from scratch in the manufacture of guns in this war. The Bren machine gun factory (John Inglis Co., Toronto) is far ahead of schedule. The same is true of a factory making heavy field guns. A rifle plant has been built. By the latter part of 1941 Canada expects to be independent in gun production, not dependent upon any other country. Canada has not been so handicapped in shell manufacture, because it took up this time where it left off in the world war.

Output of some alloy steels in Canada has been quadrupled since the war began. Some $48,000,000 is being expended for increased production of aluminum and $20,000,000 for chemical factories. Ground has been broken for a third explosives plant, this one to be located in western Canada.

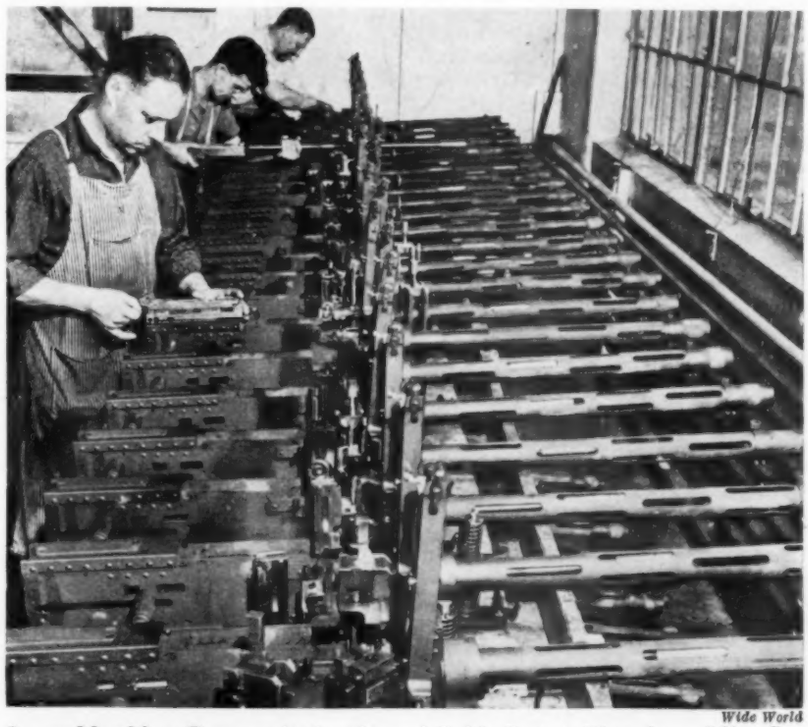
DESIGN IDEAS ARE WELCOME

WASHINGTON—Both Army and Navy will welcome any worthwhile ideas on design or process. Commissioner Coe of the U. S. Patent Office indicates that only one in a thousand submitted are worthy of consideration but these are passed along to the Research Division of the Defense Commission. However this routine for suggestions is easily sidestepped by engineers and industrialists of standing by direct approach to Army and Navy officers.

Plenty of Scrap Iron and Steel In U. S., No Need for Price Rise

WASHINGTON—Committees of steel producers and iron and steel scrap dealers met with the Defense Commission last week. Leon Henderson, in charge of industrial price stabilization, said after the meeting that scrap dealers can maintain the defense supply level without price disturbance. Further meetings will be held. Orderly buying, he said, will eliminate withholding and speculation. Government will cooperate. The Commission is making surveys to determine how new areas of salvage can be made available.

This announcement, that there is plenty of scrap, puts the President's embargo on export to Japan squarely among "measures short of war."



Wide World

Army Machine Guns—*At the plant of Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., men are inspecting the .50 calibre machine guns being manufactured for the U. S. Army. Both .50 and .30 calibre guns are produced and the plant is speeding production for national defense*

WRIGHT BUILDS FOUNDRY

NEW YORK—Wright Aeronautical Corp. has established America's first line production foundry devoted exclusively to the molding and casting of aluminum alloy cylinder heads for aircraft engines for national defense. Observers indicate that the establishment of the auxiliary foundry will prevent a bottleneck from developing in the manufacture of cylinders and will be an important factor in increasing Wright's production to meet the requirements of the defense program. The new foundry has facilities providing for all manufacturing operations from raw material to finished product.

G. E. Lighting Conference Studies Industrial Illumination

CLEVELAND—More precise application of lamps to industrial and non-industrial illumination was forecast at the Lighting Conference staged at the General Electric Institute, Nela Park. Officials and engineers of the Lamp Department, General Electric Company, offered two-score business lamp editors a new concept—that lamps are essentially generators of radiant energy. Thus, if the specifications of the seeing task are adequately known, lamps emitting the proper wave length and color can be selected to provide satisfactory optical control, reflection—diffusion properties, color, and size or contour perception.

Flourescent lighting has grown from practically nothing to a $40,000,000 industry in the past 30 months. Papers presented by G. E. engineers discussed various forms of fluorescent lighting in stores, offices, drafting rooms and shop interiors.

High-bay lighting in factories, wherein glare-free illumination of the working plane may reach 50 ft. candles, can be adequately met with combined incandescent and mercury vapor lamps. For illumination of bench or machine, where the light source is nearby, modern fluorescent lighting fixtures provide cool but intense light. Daylight or white light can be selected according to the nature of the seeing task. Light tubes from a 40-watt size 18-in. long to a new 100-watt model 5 ft. long were exhibited.

At the conference it was disclosed that G. E. is now prepared to furnish fluorescent fixtures with controls that suppress the stroboscopic effect that formerly has been distressing to workers viewing moving machinery elements. A new-type fixture has been developed for explosion hazards, such as ammunition loading plants.

Wholesale Standardization of Airplanes Deferred Until 1942; Designers Plan Change

WASHINGTON—A few months ago standardization of airplane types was the panacea that was going to provide lots of planes quickly. Now that the program is drawn up and the contracts let, it turns out that the planners were too optimistic. There has been some reduction in the number of Army types, but in general standardization has been deferred until the big model change in 1942,—when new models will be ordered.

Only in the case of the light attack bombers has Army standardized on a single combat model, a Douglas. The North American advanced trainer and the Vultee basic trainer are now standard, but on all other types at least two models and sometimes more are being bought.

The vital question of standardization as between British and U. S. demand has hardly been touched as yet. An exception is the Curtiss pursuit plane, P-40D, which is identical with the export model. The U. S. Navy and the British are attempting to get together on Consolidated ships, but more typical is the situation at Martin, where parallel assembly lines are turning out one medium bomber for this country and a different one for England.

The basis for this situation is the decision that in a period of major expansion (from a present 10,000,000 sq. ft. to about 25,000,000 ft.) production can only be held at a high level if each manufacturer is working on types he is familiar with. This applies especially to engines and reflects over into airplanes. When two engines of similar output are differently shaped, there must be different airplanes available in which to use them.

In 1942, when the major part of the expansion will have been accomplished and the 35,000-plane program completed, the picture will change. In going over to new models for the next U. S. and British program, it will be possible to do some real standardization. Designers are now working on that basis. If we are at war, this will mean one model in each type. If not, we will probaly retain some competition by using two of each type.

Under the present program, Army is buying two heavy bombers, Consolidated and Boeing. There are two medium bombers, Martin and Douglas. There are four single-engine pursuits: Republic, Bell, Curtiss and North American. Both Lockheed and Grumman are making two-engine pursuits. No attempt at all is being made to standardize trainers.

Export of Machinery During August, 1940

	August 1940	July 1940	August 1939
Electrical Machinery and Apparatus	$9,688,513	$8,890,619	$8,696,318
Power and generating machinery except automotive and electrical	1,462,055	1,522,915	1,560,056
Construction and conveying machinery	2,821,332	2,352,152	2,450,330
Mining, well and pumping machinery	4,144,971	4,746,107	5,613,157
Power-driven, metal-working machinery	21,420,050	14,906,312	9,870,911
Other metal-working machinery	938,687	582,087	439,774
Textile machinery	1,141,173	937,061	753,699

Metal-Working Machinery

Engine lathes	$1,024,332	$727,930	$511,526
Turret lathes	1,326,523	1,019,565	847,477
Other lathes	1,457,000	629,638	451,747
Vertical boring mills and chucking machines	1,333,474	307,944	345,972
Thread cutting and automatic screw machines	1,377,950	523,749	568,977
Knee and column type milling machines	756,859	587,325	378,887
Other milling machines	2,107,320	1,315,960	1,307,131
Gear cutting machines	836,626	484,344	236,851
Vertical drilling machines	369,218	142,756	27,610
Radial drilling machines	230,760	206,836	74,503
Other drilling machines	318,015	494,947	139,089
Planers and shapers	564,407	855,283	338,547
Surfaces grinding machines	713,839	167,122	179,209
External cylindrical grinding machines	579,583	399,539	184,612
Internal grinding machines	924,321	485,327	465,997
Tool grinding, cutter grinding and universal grinding machines	718,869	354,798	436,371
Other metal-grinding machines and parts	1,567,809	909,175	425,013
Sheet and plate metal-working machines and parts	764,546	1,850,366	612,220
Forging machinery and parts	979,220	337,997	359,648
Rolling mill machinery and parts	1,175,648	1,006,770	755,812
Molding machines	39,616	221,124	176,482
Other foundry equipment and parts	165,777	90,159	118,476
Other power-driven metal-working machines and parts	2,083,228	1,976,694	1,103,455
Pneumatic portable tools	117,693	102,356	146,365
Other portable and hand or foot-operated metal-working machines and parts	197,447	147,000	133,609
Chucks for machine tools	56,254	70,448	21,906
Milling cutters, machine-operated threading dies, and taps and similar machine-operated metal cutting tools	197,344	107,030	73,228
Other metal-working machine tools and parts	369,949	155,213	64,666

Over $7,000,000 in Contracts Cleared; Machine Tools Needed

NEW YORK — Contracts totaling $2,153,436,283 for the Army had been cleared by the Defense Commission up to September 28, declared William S. Knudsen at the annual dinner of the Army Ordnance Association, October 8. This amount, distributed among 531 manufacturers, does not include work allotted to the arsenals. On top of that volume the Defense Commission has cleared Navy contracts for $5,100,000,000.

Output of planes in October, said Mr. Knudsen, will be 900-950 against a schedule of 1,133. Plans call for production of 1,250 planes a month by January 1 and 1,500 by July 1, stepping up to a goal of 3,000 monthly by the spring of 1942. Aircraft engine output in September was about 2,400 units, of which 1,500 were combat engines and the balance trainers. Tank production is around 100 a month of the 13-ton type. Heavier tanks will begin to come off lines next May. Arsenals are working 24 hr. a day on anti-tank and anti-aircraft guns, and private manufacturers will come in as fast as they can get the tools. Machine guns are all placed. Eleven powder and explosives plants have been located and five more are projected.

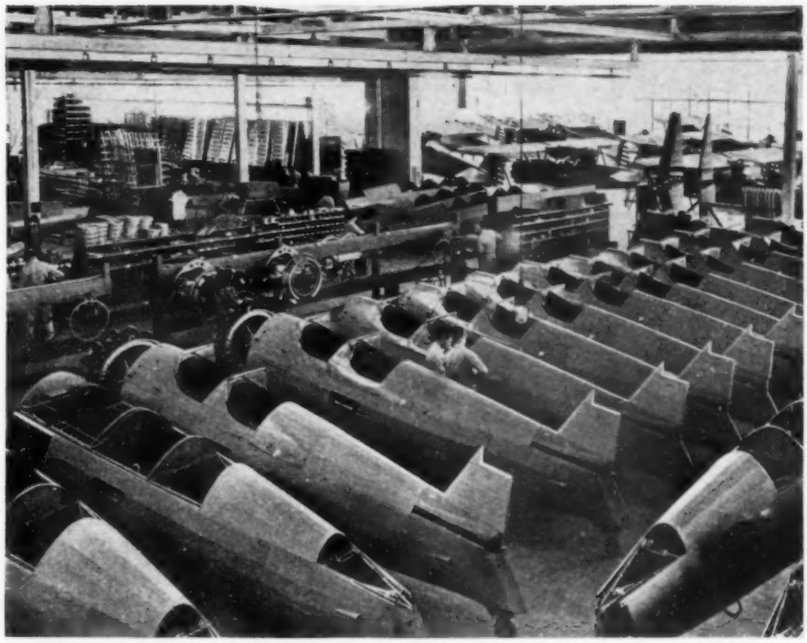
Defense Needs Machine Tools

Mr. Knudsen said that defense requirements would take the entire machine tool output the coming year. He stressed the debt industry owes to machine tool builders for developments carried on thru the depression.

Taking exception to Attorney-General Jackson's opinion that companies could not work for the government after NLRB had found them guilty of Wagner Act violations, Mr. Knudsen defined his conception of a sound labor policy. Said he, "I have no objection to collective bargaining or to committees so long as they restrict their activities to their prescribed fields, but I don't want to go beyond this."

America must not expect its procurement program to be delivered within a few months, said Major General James H. Burns, executive to the Assistant Secretary of War. Corresponding programs for the creation of capacity and production of reserves cost both England and Germany some four years of time, and if America can cut this factor in half, she will have done a remarkable job.

Brigadier General R. H. Somers, chief of the technical staff, Ordnance Department, described the types of weapons and projectiles the Army is now using as defense against tanks, saying that "The present trend is toward solid projectiles provided with wind shields to decrease air resistance and with ballistic caps to increase their penetrating ability."



Quick Production—*At the Boeing Airplane Co., Wichita, Kansas, primary training planes for the U. S. Army are being completed at the rate of one every three hours. Within four months the production rate can be further increased to one plane every 90 minutes*

Labor Leaders Faced with a Public Opinion Determined to Arm for Defense; Strategy Fails

NEW YORK—The recent skirmish in the 4-year-old guerrilla warfare between Bethlehem Steel and the C.I.O. highlights labor strategy, 1940 model. For a long time, the organized labor movement has been lobbying and campaigning to get all firms who refuse to enter into contractual relations with unions, barred from government business. With Sidney Hillman as their advocate on the Defense Commission, union officials managed to get a Labor Day statement from the National Defense Advisory Council which underwrote the New Deal labor laws. Subsequently President Roosevelt transmitted this statement to Congress.

When it became apparent that this declaration of policy had not served to usher in a new order of things, the unions sought a device for implementing the declaration. Hillman asked Attorney General Jackson for a ruling on the eligibility of companies, charged by the National Labor Relations Board with indulging in unfair labor practices, to receive federal contracts. Jackson's "informal opinion" giving the unions exactly what they wanted, the consequent storm of protest, and the full dress hearing of the Smith Committee which took testimony from War, Navy and Defense Commission officials and ended up by hearing the Attorney General, not too neatly but effectively, reversing himself—the whole shebang was nothing but a lot of very fancy trimming for C.I.O. *vs* Bethlehem Steel.

The Bethlehem case is typical of situations in which the new unions, after their dramatic and unprecedented successes of 1936-37, stalled. In auto, the open shop citadel of Ford, in rubber Goodyear, in steel National, American Rolling Mills, and Bethlehem, were some of the bastions which did not fall before the trumpetings of the new unionism. In 1938 and 1939 the C.I.O. was occupied in "consolidating" what it had. It did not extend its organizational lines. In the lean months it played close to its vest, fighting to hold what it had. To be sure, there was a curtailed staff of organizers in the field doing their day-to-day jobs of "missionary" work among the unorganized in the mass production industries. But conflicts, showdowns, and tests of strength were avoided.

Now men have gone back to work. Dues payments are flowing into union coffers. There is hay to be made. But the climate has changed. These are not the lush, tolerant days of '36-'37 when public opinion met sit-down strikes, slowdowns, quickies, and picket lines with apathy. The whole industrial boom is based on the determination to arm, and arm fast. Any brake on production evokes the full sanctions of popular disapproval.

Britain and Canada Make More Commitments For War Plants; Fear Labor Shortage

MONTREAL—Although the British and Canadian governments have already financed the construction of some $225,000,000 of armament and war material plants, further commitments totaling approximately $150,000,000 are planned for new war plants. Present production is measured by an annual output of $1,000,000,000 to $1,500,000,000.

Among the new plants, which just a short time ago was decided as not necessary to be built in Canada, is an airplane engine plant. At present, however, the need is considered so great that Britain is sending skilled craftsmen to Canada in order to speed up production. Britain will also supply the patents for an English-type engine and it will mark the first time that airplane engines have been produced in this country with the exception of an experimental engine produced by the Canadian Car & Foundry Co.

At the moment there are 11 different types of airplanes being made in Canada: Avro-Ansons, Bolingbroke, Hampdens, Hurricanes, Lysanders, Stranrears, Harvards, Fleet 60, Norsemen, Tiger Moth and Fleet Finch. Bolingbroke and Hampden bombers and the Hurricane fighters are being made for the British government. All the others will be used in Canada, mostly for training purposes. The Hampdens, Bolingbrokes and Hurricanes will be powered with English made engines, the training planes with American engines.

Recently Canada has been producing airplanes at the rate of 130 per month of which approximately 110 have been training planes. Production is being steadily increased, however, and by March of next year the schedule calls for a production rate of 320 to 360 planes per month. Two-thirds of these will be for training purposes.

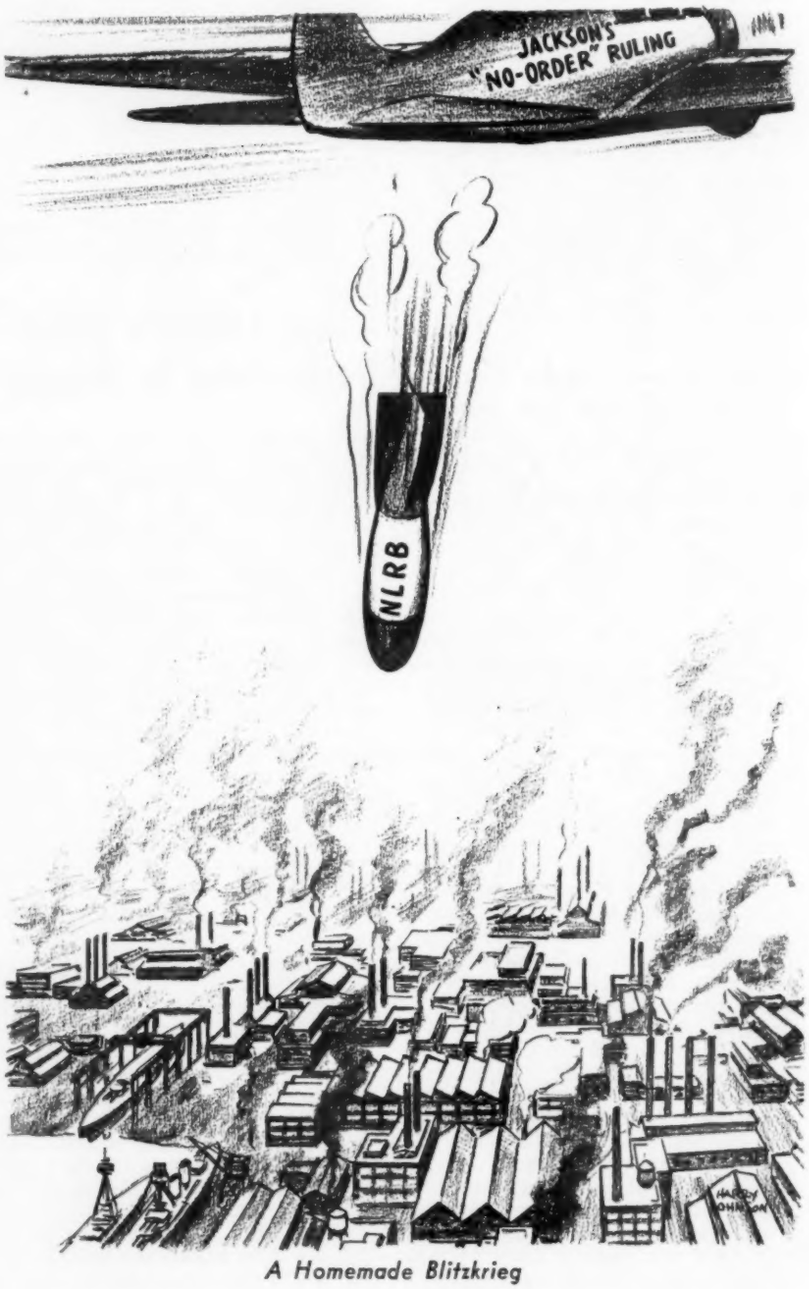
Intense Labor Shortage Seen

The plans for the construction of more war plants will intensify the labor problem. On Sept. 1, 1940 industrial employment was at an all-time high and only a few of the new government war plants had started production. Most of the new plants were scheduled to come into production during the six months following this date. All of which indicates to many observers that the shortage of skilled labor is becoming increasingly serious. So important is this problem considered that the government is expected to name a labor administrator with complete authority to divert manpower wherever the need is greatest and the work considered most essential.

Among recent war contracts received was a $2,500,000 order for propeller parts which will be provided by Canadian Car & Foundry Co. Other contracts awarded are: Aircraft, Canadian Vickers, Ltd., Montreal, $23,708; Noorduyn Aviation, Ltd., Montreal, $94,873; Walter Kidde and Co., Montreal, $10,193. Machinery, Rudel Machinery Co., Ltd., Montreal, $32,276; Williams & Wilson, Ltd., Montreal, $38,668; Canadian Fairbanks-Morse, Ltd., Ottawa, $34,149; Boyles Bros. Drilling Co., Ltd., Port Arthur, Ont., $48,897. Munitions, MacDonald Mfg., Toronto, $13,751. Ordnance, Small Arms, Ltd., Toronto, $3,000,000.

RECENT DEFENSE ORDERS

WASHINGTON—Huge expenditures for ammunition components characterize recent defense orders which saw $6,040,000 placed with American Car & Foundry Co., $4,634,500 with J. I. Case Co., and $3,365,000 with National Tube Co. Orders for airplanes were: North American Aviation, Inc., $37,770,981; Glenn L. Martin, $99,641,880; Douglas Aircraft Co. Inc., $178,320,731; and Curtiss-Wright Corp., $3,674,526. American Car & Foundry Co. secured an order of $37,687,458 for tanks with spare parts.



A Homemade Blitzkrieg

WATCHING WASHINGTON

Despite Hillman's and Jackson's decree to deny contracts to firms against whom NLRB has issued orders, Knudsen's Commission will put defense needs first. 40-hour week begins Oct. 23

By BLAINE STUBBLEFIELD

WASHINGTON—Observers quickly concluded last week that Sidney Hillman and Robert Jackson went out on a limb in an effort to deny defense contracts to firms against whom NLRB has issued orders—and that the two men barely escaped a fall as Army and Navy and Knudsen sawed the limb off.

Sidney Hillman, labor head of the Defense Commission, asked Attorney General Jackson whether companies against whom orders had been issued by the NLRB, were in violation of the law while their appeals were pending in court. Jackson said Yes, and this was instantly interpreted to mean that the Defense Commission would deny public contracts to such companies.

Hillman and Jackson were summarily called to the witness stand of the anti-labor Smith Committee investigating NLRB—along with the Secretary of Navy and Assistant Secretary of War, both of whom, emboldened by the defiant Smith atmosphere, said in effect that production was of first concern to them and the NLRB could take a run for itself. But Army and Navy only *place* orders; the Commission must *okay them first.*

Hillman says he did not consult with members of the Commission before he called for Jackson's opinion. This became apparent when Knudsen replied in a speech that when the courts hold that a firm has violated the law of the land, then, as a matter of policy only, defense contracts should not be given that firm until it changes its practices. "Certainly the Defense Commission has no authority and does not want to undertake the job of enforcing the labor laws," he said.

The President, who is really chairman of the chairman-less Commission, alone can take decisive action. This he will not do, unless and until he is forced to, because his wish to maintain the gains of labor approximately offsets his wish to rush arms production against the dictators.

As for Stettinius and Knudsen, Hillman says he did not consult with them before he called for Jackson's opinion. The Commission long ago drafted a set of principles of awarding defense contracts, approved by the President, which contained a requirement that labor laws be observed by contractors. Neither of these Commissioners is a labor baiter by a long way.

As a general prediction of the outcome, it can be said that the Commission's "principles" regarding labor laws will be enforced with moderation. The middle course is practically mandatory. For after all, among those charged with violating NLRB, are many concerns most vital to defense. Some of them have enormous loans from RFC. It is almost funny to think of shutting them out of defense production. On the other hand, there is the whole power of the New Deal behind the Wagner Law and a pledge to maintain labor's gains.

Furthermore, the Administration cannot, at this pre-election hour, afford to permit any ruction, which would immediately go into the oppositions electioneering mill. A compromise course is good enough. For any real recalcitrant manufacturer could be whipped into line with the threat of the plant conscription law.

As this was written, the Labor Relations Board was preparing, for the Defense Commission, a list of firms whose appeals from NLRB orders are pending in court. It contains upward of 200 names. The Congressional Record carried a list, which NLRB said was inaccurate.

Price Control—A Problem

Government and industry men both are wondering whether it will be possible to control prices as the emergency program goes on. A study and report by the Brookings Institution points to spots, such as copper, zinc, lead and other basic commodities, which may spread through the whole price structure. Beyond the President's resolution against war millionaires, little price curbing is actually being done, except that the industrial price division of the Defense Commission is circulating among Army and Navy procurement officers, urging them to be careful with timing and distribution of their big orders. Even if the Commission is failing in price control, the Administration can hardly afford to admit it and take measures now; political opponents would grab any such admissions and wave them aloft. If anything is to be done, you may expect strong medicine right after election, whoever wins. Substitution of negiotiation for bidding will be almost complete by then. If purchasing agencies want to, they can force "satisfactory" terms under the plant conscription law.

THE ADMINSTRATION BACKS UP

WASHINGTON—The Administration is trying to get out of the hole into which it was thrown by the ruling of Attorney General Jackson. Lubin and Harris of the Labor Department have had several conferences with Hillman and Henderson on ways out of the situation. Jackson's efforts to interpret his ruling more liberally is believed to reflect the Administration's feeling that public reaction has been bad, and will become worse.

New Ordnance Plants Possible

The Navy has $115,000,000 which it could use to build new ordnance plants, and officers are surveying Illinois, Ohio, Pennsylvania, Kentucky, Tennessee, and some other middlewest states as possible locations. They will make their recommendations to Secretary Knox. It may be a month before any information on the decision will be available. Navy officials have said that as many as six plants are needed. The survey does not guarantee that any new plants will be built, however. The available money might be used to expand existing facilities.

40-Hour Week Begins Oct. 23

At midnight October 23, the second work-week reduction under the Labor Standards law steps down from 42 to 40 hours. Administrator Philip Fleming says employers whose regular work week begins before the midnight deadline need pay overtime only on time in excess of 42 hours for that week. The 40-hour minimum will apply to their following work week. The Administration is sternly standing its ground that the wage-hour law will add to efficiency on defense production. But much criticism is aimed at the law in general, and at the two-hour reduction in particular. Purpose of the law was to spread work for benefit of the unemployed. Now, faced with the need for fast production, employers must greatly increase their wage cost in time-and-a-half payments, or employ more men. The skilled men they need are not available—so the work-week cut simply amounts to a wage increase for many metal-working concerns.

2,550 Bombers, 5,250 Pursuit Ships Already Ordered by Army

By Robert Colborn

WASHINGTON — Army announced last week that the last ship in its 19,000-plane program had been placed under contract—about three weeks after the bulk of the money became available and a little over three months after money for the partial 4,000-plane program was appropriated. All were contracted before the tax and amortization bill was signed.

Just what sort of airplanes are under contract has never been officially announced. For the first 4,000 or so units, Army released quantities and types just to convince people they really were ordering planes. But after that War Department shut down on information except dollar totals. However, on the basis of scraps of information, some careful guessing, and a few stabs in the dark it is possible to get a rough idea of what's in the program.

Orders Equally Divided

On this basis, it appears that the orders are about equally divided between combat and training types. And it might well be that in an emergency the nearly 6,000 advanced trainers might have tactical value; back in the early thirties a 600-hp fighter would have been considered pretty hot. It is worth noting that without any allowance for replacements and spares, this program will call for better than 9,000 radial engines in the 1,500 to 2,000-hp bracket, a like number of smaller radials, and about 6,500 liquid-cooled engines of 1,000 hp. or better.

The following material is distinctly not guaranteed. Probably no figure in it is exactly right; possibly there are substantial errors. But it offers as good an approximation of the dimensions of the program as is now available.

Planes Ordered For Air Corps Under 1940-41 Appropriations

850 Heavy 4-engine bombers: 500 Boeing, and 350 Consolidated. 2,550 Medium 2-engine bombers: 1,150 Martin, and 1,400 Douglas. 400 2-engine Attack fighters: 400 Douglas. 600 2-engine Pursuit: 600 Lockheed. 5,250 Single-engine pursuit: 1,750 Curtiss, 1,800 North American, 1,000 Republic, and 700 Bell.

9,650 TOTAL COMBAT.

170 Transport: 50 Curtiss, 20 Beech, and 100 Douglas. 5,700 Advanced trainers: 2,000 Curtiss, 3,000 North American, and 700 Beech. 500 Basic trainers: 500 Vultee. 2,950 Primary trainers: 800 Ryan, 800 Fairchild, and 1,350 Stearman.

9,320 TOTAL NON-COMBAT.

18,970 TOTAL ALL TYPES.

18,640 OFFICIAL TOTAL.

Secretary Perkins Predicts New Employment Record; 4 Million Defense Jobs Available

WASHINGTON—The next year will bring the largest increase in employment this country has even witnessed, predicts Secretary of Labor Perkins on the basis of a report made to her by the Labor Department's Bureau of Labor Statistics.

Jobs for 5,000,000 to 6,000,000 persons are seen as a real possibility and with defense industries alone employing about three to four million workers by the end of 1941. The economic significance, Miss Perkins indicates, is that the payrolls or defense workers will lead to more employment in automobile and furniture factories, in textile mills and clothing factories. Retail stores and service industries will all be stimulated. Although the indirect effect of defense expenditures on employment in non-defense industries is felt only after several months, it should bring about an increase in employment of approximately two million additional workers. Some observers indicate that the increase of consumers purchasing power, the result of increased employment, will go a long way toward reducing labor skirmishes and increasing business income.

During June, July and August the Navy let contracts or undertook force-account work for vessels to cost $1,076,000,000. The Bureau of Labor Statistics estimates that by the end of this year 30,000 people will be at work on vessels contracted for in June, July and August. This number will rise to 100,000 by the late summer of 1941 and will reach a peak of 150,000 in the spring of 1942. This estimate does not yet include employment on contracts let in September or to be let in later months.

Of the 4,540,000 man-years of defense industry labor about half will be needed on construction jobs, in shipyards or in factories engaged in making finished products like airplanes and engines, tanks and shells. Some 2,320,000 man-years of labor will be needed primarily to supply the contractors with materials. This labor will extend back into the mines and forests, into plants making semi-finished products, to the railroads and other carriers, and to all workers.

U. S. Government Contracts Awarded to Metal-Working Firms

Contractor	Gov't Agency	Commodity	Amount
Budd Wheel Co., Detroit, Mich	War	Shells	$309,282
Murray Mfg. Corp., Brooklyn, N. Y	War	Shells	902,000
Auto Specialties Mfg. Co., St. Joseph, Mich	War	Shells	1,653,750
Aetna-Standard Engineering Co., Youngstown, Ohio	War	Gun carriages	1,703,050
Pollak Mfg. Co., Arlington, N. J	War	Fuses	349,760
General Electric Co., Schenectady, N. Y	War	Radio	5,288,562
Federal Telegraph Co., Newark, N. J	War	Radio transmitter	.....
Ryan Aeronautical Co., San Diego, Calif	War	Airplanes	2,074,234
Timken-Detroit Axle Co., Detroit, Mich	War	Adapters	624,030
General Motors Corp., (Chevrolet Div.) Detroit, Mich	War	Trucks	276,876
Boeing Aircraft Co., Seattle, Wash	War	Airplanes	70,449,955
Indian Motorcycle Co., Springfield, Mass	War	Motorcycles	182,540
Harley-Davidson Motor Co., Milwaukee, Wisc	War	Motorcycles	242,515
Bendix Products Division, Bendix Aviation Corp., South Bend, Ind	Navy	.....	.....
Vought-Sikorsky Aircraft Div., United Aircraft Corp., Stratford, Conn	Navy	.....	.....
Reo Motors Inc., Lansing, Mich	War	Trucks	283,800
American Forge Div. of The American Brake Shoe & Foundry Co., Chicago, Ill	War	Forgings	244,110
Pullman-Standard Car Mfg. Co., New York, N. Y	War, Ordnance	Motors	838,150
Kennedy-Van Saun Mfg. & Eng. Corp., Danville, Pa	War, Ordnance	Mortars	638,269
Continental Motors Corp., Muskegon, Mich	War, Ordnance	Engines	1,370,311
International Harvester Co., Inc., Washington, D. C	Navy	Trucks	130,144
Douglas Aircraft Co., Inc., Santa Monica, Calif	Navy	Airplanes	9,602,384
General Machinery Corp., Hamilton, Ohio	Navy	Lathes	588,598
Stewart Warner Corp., Chicago, Ill	War	Artillery ammunition components	1,381,600
Pullman Standard Car Mfg. Co., Butler, Pa	War	"	1,134,000
National Supply Co., Ambridge, Pa	War	"	720,000
Norris Stamping & Mfg. Co., Los Angeles, Calif	War	"	2,544,000
Electric Auto-Lite Co., Toledo, Ohio	War	"	780,000
Scoville Mfg. Company, Waterbury, Conn	War	"	2,358,000
Chase Brass & Copper Co., Waterbury, Conn	War	"	806,000
General Motors Corp., Anderson, Ind	War	"	2,536,000
Pennsylvania Forge Corp., Philadelphia, Pa	War	"	790,000
General Motors Corp., Dayton, Ohio	War	"	1,208,199
Independent Lock Co., Fitchburg, Mass	War	"	965,000
Eastern Rolling Mill Co., Baltimore, Md	War	"	1,883,000
E. I. duPont de Nemours & Co., Inc., Barksdale, Wis	War	Ammunition components	305,500
Revere Copper and Brass, Inc., Baltimore Div., Baltimore, Md	War	Ammunition components	268,100
American Brass Co., Waterbury, Conn	War	Ammunition components	418,575

INSIDE DETROIT

Despite uncertain outlook for price and supply of materials the auto industry sticks to short-term commitments. Sales of 1941 models show good advance. Record output seen for October

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT — Despite universal optimism that automobile sales will continue at record pace, the automobile industry is not making long-term commitments for materials. Steel makers, for example, have attempted to convince purchasing agents that it would be wise to give definite orders to cover the bulk of the model run, so that the mills can fit automotive requirements into their heavy rolling schedules to the best advantage. One of the arguments advanced in support of this proposition is that priorities for national-defense may interfere with deliveries later on, and that with definite orders on the books the steel industry could anticipate priorities for the sake of its best customer.

These pleas have met with little response. Orders are current only for the steel consumption anticipated within the next 60-90 days. Of course, one of the most potent levers toward huge initial commitments—that of price slashes to feed hungry mills—is absent this fall. While it is true some flat-rolled business was taken in the summer months for less than stated prices, that tonnage was quickly rolled and shipped. Since then the orders have been taken at full price without question, and there have been no squawks over raising the price of alloy steels a few dollars per ton.

Sales Outlook Is Interesting

Automotive purchasing agents are more interested this season in the outlook for late fall and winter sales of the 1941 series than in the more remote questions of possible priorities, price and available supply of raw materials next spring when the full impact of the defense program will be felt. Their present policy of placing orders for normal supplies is dictated by that of top management, as ably expressed by M. E. Coyle, Chevrolet general manager. In speaking on production plans for the balance of the year, Mr. Coyle said that Chevrolet will produce at rated capacity of 5000 cars daily until initial demand is satisfied, dealers are well stocked and the continuance of demand can be appraised from short range. With steel covered until the year end, it will be several weeks before new buys are made, thereby indicating what the automobile companies think of production possibilities in the first quarter.

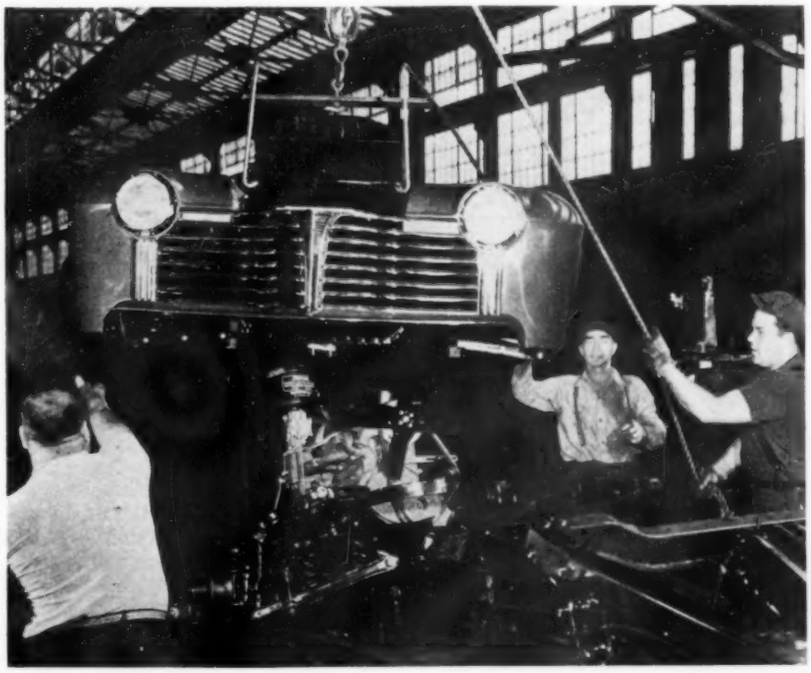
It is anybody's guess what the situation will be next March when purchasing agents must make buys to complete the model run. Some of them privately express fears that priorities or shortages of supplies may interfere with production, or that prices will be sufficiently higher to force an increase in car prices at that time. Yet the national-defense program is unlikely to require more than 10 per cent of the nation's steel capacity in the opinion of leading steel operating men. And the steel industry is making such good profits at the present rate of operation that it is unlikely to go counter to public opinion by raising prices except where shortages of alloys dictate such a move.

There is another angle that must not be forgotten in appraising the automobile industry's caution about long-term commitments for raw materials. Reliable sources report that some managements fear that output may be restricted next spring, if the present Administration is re-elected. Despite the importance of the auto industry in the national economy, it is felt that certain political quarters may attempt to force curtailment of output on the ground that raw materials, labor and plant facilities are required for national defense purposes.

Automobile sales during September show large gains over the same month last year. Chevrolet disposed of 47,363 cars, a gain of 65 per cent: Pontiac, 14,633, a gain of 69.6 per cent, giving that company the largest September since 1923: Buick, 23,957, up 113.6 per cent.

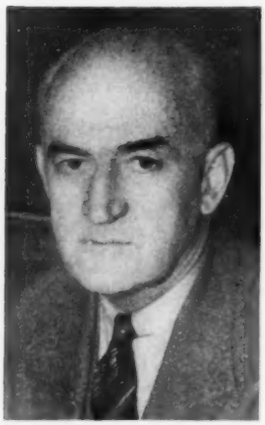
ARMOR PLATE ORDERS

DETROIT—In connection with Chrysler's program to build 25-ton tanks for the Army, local circles understand that an order to fabricate the main armor-plate structure will be let to a major steel company in two or three weeks. The cast turrets are a separate proposition. Chrysler would like to fabricate a portion of the order, but its wishes may be over-ruled. The plan under contemplation calls for shipment of the complete structure ready for assembly at the government tank arsenal now under construction in Detroit. About 14,000 lb. of rolled armor plate will be needed for each tank and thicknesses have been under debate. Case-hardened automotive steel, similar to SAE 4820, has been tested ballistically and found satisfactory.



On the Hump—*Pontiac's final assembly line conveyor has a hump that lifts the chassis to the mezzanine where the front-end sub-assembly is produced. The conveyor hump also provides a much needed passage under the long final assembly line*

Executive War Officer



JAMES H. BURNS

Chief at Watervliet

RICHARD H. SOMERS

Directs Procurement

HARRY K. RUTHERFORD

Commands at Aberdeen

JOHN B. ROSE

These gains are spectacular but they do not represent a true measure of the public's reaction to the 1940 and 1941 models respectively, because announcement of new models occurred several weeks earlier this year. Upon comparing initial selling periods for the two seasons, Buick is found enjoying an acceptance approximately 22 per cent better than last year while Chevrolet is about on a par. Ford products are reported to have had a better pre-show response than last year, but actual figures are lacking. In other words, there seems to be some indecision on the part of the public toward jumping into the new-car market. Used-car sales continue strong, and the gain in inventories is not commensurate with the more active trading since introduction of 1941 models.

Sales Best in Years

Cleanups of outgoing models were universally the best in recent years. A survey of several leading makes disclosed that at announcement time for the respective makes, 1940-model stocks ranged from less than one to two cars per dealer. Experience shows that most of these were demonstrators. A typical case will illustrate how effective cleanups were: Pontiac had 3,073 cars in the hands of its 3,800 dealers at announcement. At the end of the second ten-day selling period, this number had shrunk to 1,000 and by the month-end all 1940 models had been cleaned out.

Current assembly rates of the various manufacturers promise to push October output to a new record of 475,000 for the month. But contrary to experience in 1938 and 1939, the assembly rate will reach a peak in October instead of December for the fourth-quarter period. Estimates have placed November at 450,000, December at 400,000 plus. Sales quotas established by leading makers are based upon retail disposal of two-thirds of the cars manufactured in the last quarter.

Whereas introduction of the Champion tripled Studebaker output, Nash is counting upon the Ambassador 600 to account for only one-third of the 12,500 cars scheduled for October. Lowering the prices on the medium-priced sixes and eights and improving the dealer margin on those two lines is expected to place production emphasis on the larger six for the time being.

Aircraft Activities Expand

Stinson Aircraft Corp., now a division of Vultee, will soon return its commercial aviation business to the Wayne, Mich., plant and expects to employ 1000 persons. A year ago the commercial business and a newly developed line of military ships were transferred to a new plant at Nashville, Tenn.

Growth in importance of both military and commercial phases of the business dictates re-opening the Wayne plant and segregation of the two activities. The Tennessee plant will in the future be known as the Nashville Division of Vultee, and the Wayne plant will become the Stinson Division.

Stout Skycraft Corp. is making rapid progress in determining production methods for the stainless-steel training ship developed by W. B. Stout and may be ready to go into production shortly after the first of the year.

Tucker Aircraft Corp., which has been developing confidential engines for the Army (originally company officials mentioned aviation and tank engines before the lid was clamped on) reports that development work may be completed by next March.

Rutherford, Lewis, Rose, Somers, Campbell and Burns Named Generals

WASHINGTON—Harry K. Rutherford, Burton O. Lewis, John B. Rose, Richard H. Somers, and Levin H. Campbell have been appointed Brigadier Generals of the United States Army, and James H. Burns has been named Major General.

Major Gen. Burns will continue his duties as the executive officer, office of the Assistant Secretary of War, and Brigadier Gen. Campbell will continue in charge of plant facilities for Industrial Service of the Ordnance Department. General Somers will continue as commander of the government arsenal at Watervliet, N. Y., and General Rutherford will continue as director of the Procurement Planning Branch in the office of the Assistant Secretary of War. General Lewis will continue in charge of production for Industrial Service of the Ordnance Department, and General Rose will continue to command the Aberdeen Proving Ground.

WILL SEIZE MACHINE TOOLS

WASHINGTON—Machine tools held for export but kept in this country by inability to obtain an export license can now be seized by the President and put to national defense work. As the bill granting this power finally passed, it permits tools so seized to be re-sold, so that they are available for use in private plants as well as in government arsenals. The power was particularly needed to meet the not infrequent case in which title has already passed to a foreign owner, who is unwilling to sell.

Eastern Division of Air Associates Moves Into New Plant at Bendix, N. J.

BENDIX, N. J.—Air Associates, Inc., started production in its new $500,000 plant on Oct. 1 after machinery, office furniture and all company equipment had been moved overnight from the old plant at Roosevelt Field, Long Island, N. Y. Transfer of the company's activities to its new plant were marked by dedication ceremonies at which Gov. Harry Moore and other New Jersey state officials participated.

Organized in 1927 by Haven B. Page, primarily as a distributor of airplanes, aviation parts and equipment, Air Associates in the intervening years has changed its character from that of a supply house to a manufacturing operation. Today, manufactured products represent the major portion of the company's business. Among the products made are many special-order precision accessories for the aviation industry, such as de-icer equipment, instruments, radio equipment, fittings, engine and airplane replacement parts, hydraulic pumps and control equipment.

Erected in a little more than two months by the Austin Company, the new plant has a one-story manufacturing area, covering 63,000 sq.ft., with floor space about evenly divided between stock room and machine shop. At one side of the machine shop are heat-treating, plating, burring, grinding departments and a completely equipped testing laboratory. The two-story building at the front of the plant which houses the executive, sales, engineering and general office staffs provides 6,000 sq.ft. on each floor.This plant doubles the company's capacity in the east.

NAMES in the NEWS

H. J. Barton and C. A. Peck have been appointed to the Tool Steel Div. of Allegheny-Ludlum Steel Corp., Pittsburgh, Pa., and Irving H. Jones has been named manager of railroad sales. Mr. Barton has been associated with steel activities on the Pacific Coast for many years, while Mr. Peck had been in the tool steel business for himself for the past several years prior to his association with Allegheny Ludlum Steel Corp. Mr. Jones was formerly manager of railroad sales for the Central Alloy Steel Corp., Massillon, Ohio.

C. Milton Ekberg and William A. Russell have been appointed field engineers of Norton Co., Worcester, Mass.

Thomas E. Bragg has been elected a director of the Greenfield (Mass.) Tap & Die Corp., Greenfield, Mass.

Assists Manager

ROGER H. CLAPP

Research Metallurgist

T. T. WATSON

New Manager

W. C. WESLOW

Formerly Mr. Bragg was associated with Donald G. Millar, chairman of the board of directors of the American International Corp.

Robert E. Brannan has been appointed manager of molding material sales of Bakelite Corp., New York, N. Y. Mr. Brannan has been a member of the organization since 1923.

Roger H. Clapp, formerly Philadelphia branch manager, has been named assistant general manager of sales of John A. Roebling's Sons Co., Trenton, N. J. Mr. Clapp has been an associate since 1936.

Archibald Cunningham has been appointed supervisor in charge of tool manufacturing at Curtis Wright Airplane Corp., St. Louis, Mo. Mr. Cunningham was formerly superintendent of Emsco Derrick & Equipment Co., Houston, Texas.

E. George Hartmann has been appointed manager of sales of John A. Roebling's Sons Co., Trenton, N. J.

Arthur Mackmann, former works manager, was elected vice president in charge of manufacturing of Foote Bros. Gear & Machine Corp., Chicago, Ill. Mr. Mackmann became associated with the corporation in 1928.

George W. Malcomson has been named assistant sales manager of the Truck Division, Dodge Bros. Corp. Mr. Malcomson joined the Dodge truck sales organization in the special equipment division in 1930. L. M. Oltman has been named special truck representative of the factory truck sales force in Detroit.

Henry R. Merrill has been appointed assistant sales manager of the Behr-Manning Corp., Troy, N. Y. Mr. Merrill who had been divisional sales manager of the central division at Cleveland has been in the employ of the company since 1930. Gordon G. Thompson, who began his career with Behr-Manning in the sales department, will succeed Mr. Merrill as divisional sales manager.

Arnold L. Nacke has been appointed sales agent in New York City for Modern Tool Works, Rochester, N. Y.

Henry J. McKenzie, executive vice president and general manager of Sterling Pump Corp., Hamilton, Ohio, has been appointed president of the organization to succeed Maurice Rothschild, who will continue as a director. Mr. MacKenzie, who will also retain his duties of general manager, has been identified with the pump industry since 1917.

John L. Schmeller has been named vice president in charge of sales of the National Bronze & Aluminum Foundry Co., Cleveland, Ohio.

J. T. Sutliff has been made in charge of the Chicago office of Roots-Connersville Blower Corp., Connersville, Ind.

T. T. Watson, former development metallurgist, has been appointed research metallurgist in charge of all plant research of Lukens Steel Co., Coatesville, Pa.

W. C. Weslow has been named manager of the mining division of Carboloy Co., Inc. For the past nine years Mr. Weslow has been field and development engineer.

M. C. Wilt has been appointed vice president and general manager of Curtis Lighting, Inc., Chicago, Ill. G. T. Morrow has been named vice president in charge of sales, H. J. Dillon, vice president in charge of production and L. N. West, secretary-treasurer.

PLANT EXPANSION

The Westinghouse Steam Division Works, Lester, Pa., a division of Westinghouse Electric & Mfg. Co. will expand its present facilities at a cost of over $9,500,000. The move was made to assure on-time delivery of turbines for 45 fighting ships of the U. S. Navy. Over $5,000,000 worth of machine tools and other manufacturing equipment are being installed.

Grumman Aircraft Engineering Corp., Bethpage, L. I., has just started construction of a new $2,100,000 blackout factory. The project, involving nearly half a million square feet of floor space and designed for the manufacture of fighting naval aircraft on a mass production basis, is scheduled for completion in four months.

Marlin-Rockwell Corp., Jamestown, N. Y., has begun construction of a one-story addition to its plant. This will provide 37,000 additional square feet of production floor space.

Producto Machine Co., Bridgeport, Conn., is expanding its plant in order to step up operations for the production of machine tools.

Bell Aircraft Corp., Buffalo, N. Y., will begin construction of a $1,000,000 plant at Niagara Falls. The new plant will be used for the assembly of pursuit planes and will have an area of 240,000 sq.ft. and employ 3,000 workers.

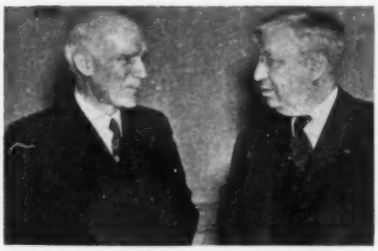
Peerless Machine Co., Racine, Wis., has expanded its manufacturing facilities in order to increase the production of metal cutting saws. Additional space for engineering research and experimental work has also been provided.

Marathon Electric Mfg. Co., Wausau, Wis., is erecting a new plant at a cost of between $150,000 and $175,000. The new plant is scheduled to be completed about January 1.

BUSINESS ITEMS

The Detroit Office of the Geometric Tool Co., New Haven, Conn., will handle the sale of Geometric threading tools and machines in Ohio. The Mill Supply Department of the National Supply Co., of Toledo, former agents of Geometric Tool Co., has been discontinued.

West Coast Industries, Ltd., has been organized at Vancouver, B. C., and will undertake the distribution of important munition orders in British Columbia. The West Coast Industries, Ltd., is a non-profit organization and its officers and directors are all serving without remuneration.



Congratulations—*A. E. Alverson, (right) secretary, Greenlee Bros. & Co., Rockford, Ill., is being congratulated for 40 years of continuous service by George C. Purdy, president. Almost 100 officials, superintendents and foremen attended the dinner given in his honor*

Powell Machine Works, Inc., Vancouver, B. C., was recently incorporated. The firm's capitalization is composed of 1,000 shares without nominal or par value.

Myron I. Arms, Youngstown, Ohio, has purchased the assets of the Franklin Engine & Mfg. Co., Franklin, Pa. The plant, formerly known as the Franklin Valveless Engine Co., has been named the Arms-Franklin Corp.

Howard Acheson of Acheson Corp., New York, N. Y., has acquired control of Acheson Colloids Corp., Port Huron, Mich. Mr. Acheson has served as president and director of Acheson Colloids since 1929.

Ralph W. Atkinson has been appointed California representative and the Weldon Engineering Co. has been appointed Chicago representative of the Tomkins-Johnson Co., Jackson, Mich.

Sterling Pump Corp., Hamilton, Ohio, has acquired the Turbine Pump Division of the Roots-Connersville Blower Corp., of Connersville, Ind.

OBITUARIES

Carter DeFriest, executive assistant to the Philadelphia Works manager of the General Electric Co., died recently.

Thomas M. Barnes, wire goods manufacturer, died recently at the age of 74. Mr. Barnes was the founder and president of Thomas M. Barnes Co., which began business in 1885.

George Switzer, 40, internationally known industrial designer, died last week after an operation. Since he established his business in 1929, he had designed everything from letterheads and sausage labels to modernistic packages and hearing devices. Mr. Switzer had done work for Westinghouse, E. R. Squibb, International Business Machines, Studebaker, and the Sonotone Corp. At the time of his death he was working on the applications of plastics to the motorcar, railroad and airplane industries. He was a former art director of Erwin Wasey & Co., advertising agency in Chicago.

Freeland O. Stanley, 91, co-inventor of the Stanley steamer automobile, died recently at his home in Newton, Mass. A native of Kingfield, Maine, Stanley and his brother, Frank, first manufactured their steamers in 1897 and production continued until 1923 when the brothers had retired. Their automobile was the first car to travel a mile in less than 2 minutes.

MEETINGS

American Management Association. Annual conference. Cleveland Hotel, Cleveland, Ohio, Nov. 12 and 13.

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21–25.

American Society of Mechanical Engineers. Annual convention. New York, N. Y., Dec. 2–5.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17–19.

American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20–25.

Associated Machine Tool Dealers of America. Annual convention. Dayton, Ohio, Oct. 21 and 22.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y. Dec. 2–5.

National Metal Exposition, Cleveland, Ohio. Cleveland Public Auditorium. Oct. 21–25.

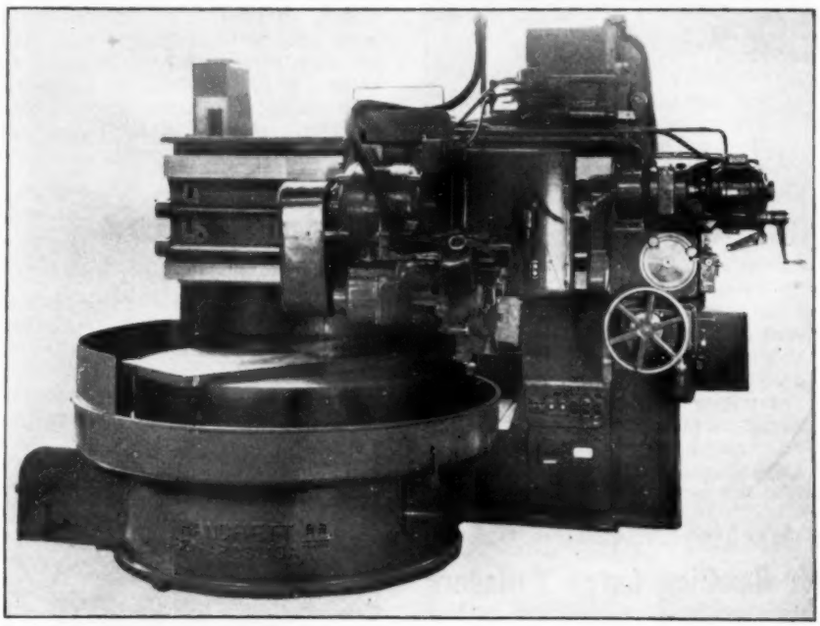
Society of Automotive Engineers. National Aircraft Production Meeting. Hotel Biltmore, Los Angeles, Calif. Oct. 31–Nov. 2.

Society of Automotive Engineers. National Fuels and Lubricants meeting. Hotel Mayo, Tulsa, Okla. Nov. 7-8.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17–23.

SHOP EQUIPMENT NEWS

Hanchett "Rotary Plano" Surface Grinder Mounts Horizontal or Vertical Spindle

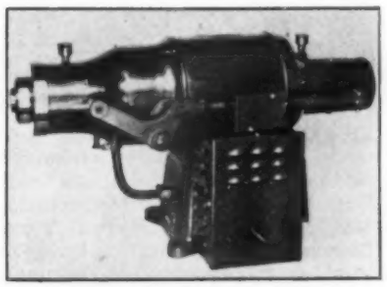


Provision for either a horizontal or vertical spindle is one of the features of the "Rotary Plano" surface grinder offered by Hanchett Mfg. Co., Big Rapids, Mich. The horizontal spindle will accommodate a straight wheel, while the vertical spindle can be fitted with either a cylindrical or segmental wheel. In any combination the wheelhead can be fed automatically or by hand in increments of from 0.0002 to 0.0030 in.

Grinding wheel, driven by a 30-hp., 1,200-r.p.m. motor, is mounted on a cross rail between two columns. This rugged counter-weighted rail has power elevation provided by a 5-hp. motor and is automatically clamped to both main and auxiliary columns. Grinding wheelhead has adjustable cross feed with a range of speeds of from 3 to 9 in. per min., driven by a four-speed ¾-hp. motor. Ways on which the wheelhead travels are tiltable to 5 deg. in either direction.

The 72 or 84-in. table is driven by a 15-hp. motor through a variable-speed unit, which gives a range of table speeds from 6 to 18 r.p.m. It swings work up to 90 in. in diam.

Machine illustrated has a 24-in. diameter wheel with a 5-in. face and is grinding a 76x36-in. die plate held on a magnetic chuck. Weight of this machine with a 72-in. magnetic chuck is approximately 75,000 lb.

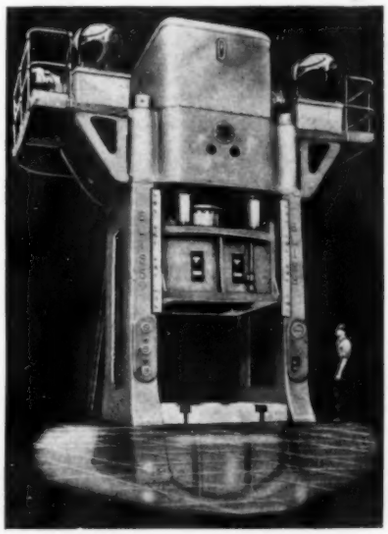


High-Production Speed Lathe Permits Continuous Operation

Considerable time can be saved and heavy bench lathes freed for other work with the high-production speed lathe built by Schauer machine Co., 2060–8 Reading Road, Cincinnati, Ohio. Suitable for such light finishing operations as burnishing, lapping, burring and polishing, this machine has been especially designed to permit continuous high-speed operation. Collet and spindle are magnetically controlled and are engaged or disengaged by operation of a pedal. Special built-in features are available to handle rods, tubes or stock.

Bliss 800–200-Ton "Hydro-Dynamic" Press Built for Economical High-Speed Operation

The 800–200-ton "Hydro-Dynamic" press made by the Hydraulic Div. of E. W. Bliss Co., 53rd St. & Second Ave., Brooklyn, N. Y., has been designed especially to incorporate a simple cycle, smooth operation at high speed, and economy of operation and maintenance. Press is of the double-action type with universal electric control, and is equipped with an auxiliary hydraulic pressure cushion in the bed.

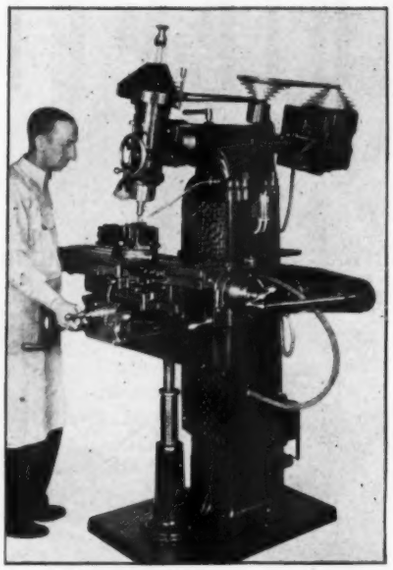


Two 125-hp. motors operate the press at high speed. Pushbutton control is such that the inner main slide cannot contact the work until after the desired blankholder pressure is applied by the outer slide. The main drive brings the two slides simultaneously to the work, the inner slide halting for a fraction of a second, while the blankholder pressure is applied, and then proceeding at the draw speed. Reversal may be controlled either by slide position or by pressure in the system. Positive inching for die setting is by pushbutton with the quick advance eliminated, permitting increments of approach of 1/16 in. or less.

Press features close-fitting gibs, normally open prefill valve and holding valve. Eliminating cavitation and allowing the machine to purge itself freely of air secures fast generation of pressure and assists materially in achieving high speed. Equipment is self-contained throughout, and is

complete with air filter, oil filter, oil strainers, circulating oil cooler and indicating oil temperature gage.

Specifications: main slide capacity, 800 tons; blankholder slide capacity, 200 tons; bed cushion capacity, 150 tons; bed area, 84x85 in.; maximum slide stroke, 42 in.; over-all height, 340 in.



Improved "Millmaster" Miller Provides Increased Capacity

Several improvements have been made in the recently announced "Millmaster" vertical milling machine built by Midway Machine Co., 2324 University Ave., St. Paul, Minn. De luxe models now include center or third pulley attachment and table power feed attachment as standard equipment, table length has been increased from 26 to 38 in., and weight from 1,600 to 1,800 lb.

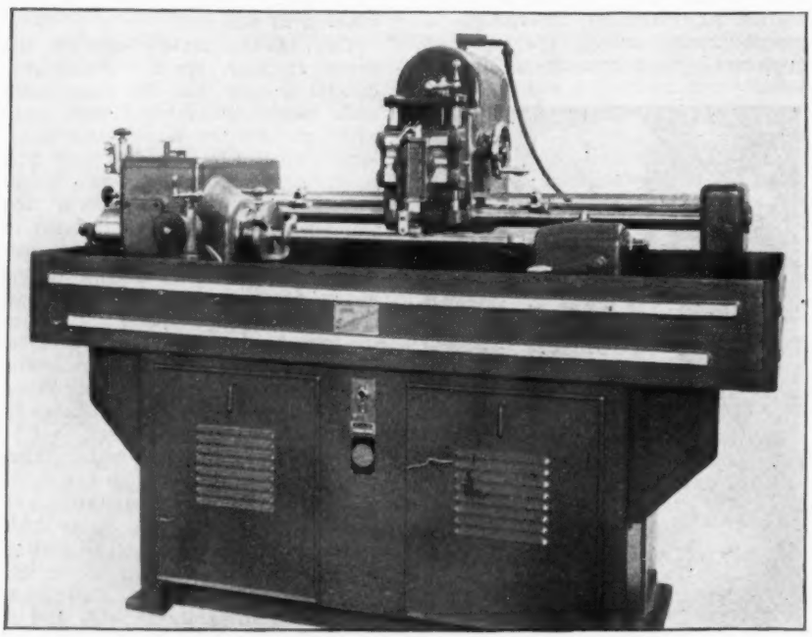
Table power feed unit furnishes power feed to table on longitudinal travel only. A ¼-hp., three-phase motor provides 7 feeds, forward and reverse. All standard models are now furnished with a motor-driven pump and storage tank for coolant. An indexing headstock and tailstock has been made available for all models; and vernier attachments for greater precision are now also available for all models. Also obtainable are special end mill holders for heavy-duty milling. These are optional in place of collets, as standard equipment, or available as accessory equipment.

Foster 4x36-in. Superfinishing Machine Designed for Handling Large Cylinders

The 4x36-in. Superfinisher developed by Foster Machine Co., Elkhart, Ind., has been designed for work larger than can be accommodated on the general purposes Superfinisher previously announced. It is claimed to be ideal for the larger sizes of guide bars for die sets, piloted boring bars, and almost any cylindrical work up to 4 in. in diameter and 36 in. in length. The machine can also be built to accommodate work approximately 50 in. between centers.

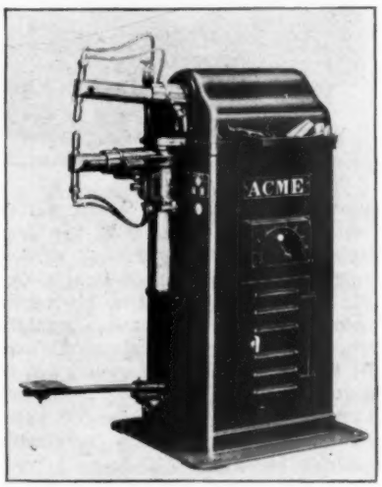
Like the general purpose unit, the 4x36-in. model is designed for collet, chuck, or center work, and may be provided with centerless or flat surface attachments. Thus the machine is practically universal in application. Among the special features incorporated in the design is a mechanical drive to the traverse, which also has a hand adjustment for positioning. Spindle is driven by a Graham transmission with a stepless range of speeds 0 to 500 r.p.m. Spindle speed control is in a position convenient for the operator. Machine has a quick stone retraction device. Standard single and double stone holders are available.

Bars carrying the Superfinishing head are horizontally parallel, thus reducing over-all height of the machine. A positive stop for the head may be used to accurately position head in relation to surface when the traverse is not used.



"Hot Spot" Welders Made In Capacities up to 50 Kva.

As companion lines to the recently announced Types O and I foot-operated "Hot Spot" welders, Acme Electric Welder Co., Huntington Park, Calif., has developed the foot-operated rocker arm Type 2 in 20 and 30 kva. capacities and Type 3 in 40 and 50 kva. capacities.



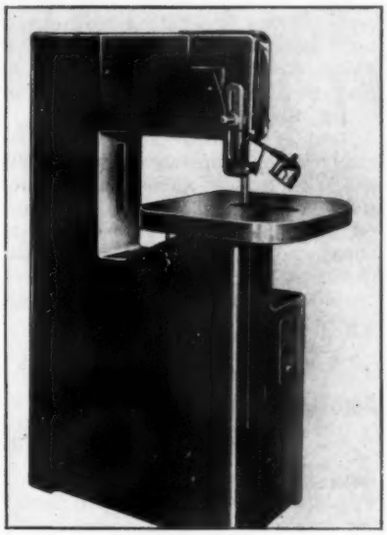
Housings of these welders are of all-welded steel. Horns are double end reversible, one end machined to hold electrodes at 90-deg. angle and opposite end at 22½-deg. angle. Arrangement of the swivel lower horn holder on a long column allows for horizontal and vertical movement of the lower horn to facilitate welding in hard-to-get-at places and deep pans or boxes.

Grob Filing Machine Made in Three Sizes

Throat sizes of 18, 30, and 36 in. are available in the improved heavy-duty continuous filing machine made by Grob Bros., Grafton, Wis. This machine consists of a one-piece

welded steel frame, inclosing a ½-hp. motor and V-belt drive in the base. Speeds of 80, 120 and 160 ft. per min. are provided. Tiltable semi-steel table measures 20x20 in.

Files are attached to a chain which is driven by the lower pulley, which has spring-cushioned pins providing a positive drive to the file chain.



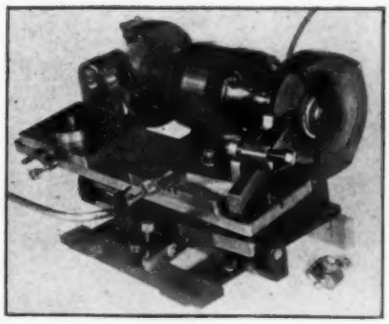
Thus little tension is required, insuring long life and accurate file alignment. As the file chain is extremely flexible, two small pulleys can be used in the upper arm as idlers. This permits a low total height with a large throat. Special built-in channels make insertion of new file chains easy.

Carbide Tool Grinding Fixture Accommodates All Tipped Types

Noyes Tool Sales, 601 Laurel Ave., Bridgeport, Conn., has developed a carbide tool grinding fixture which reduces operations to a minimum and covers practically all standard shapes and angles of carbide-tipped tools.

Two plates sliding at right angles to each other are provided, the upper slide having a double angle seat for the tool to provide for right and left tip clearance. This slide also carries a bracket for guiding the tool face across the flat side of the wheel, or at a slight angle to it. The lower slide, which moves lengthwise of the machine, grinds the end face of the tool on the wheel periphery. A guide bracket fastened to the upper slide, adjustable between stops, provides for regulation between the side face and end face of the tool tips. Grinding is controlled by hand pressure.

In operation the side face of the tool can be ground upon the flat or beveled flat of the wheel side, then the slide moved back and the tool passed by the periphery of the wheel

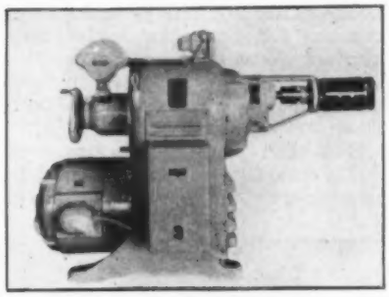


to grind the end tip. The tool is then slipped from its bracket and laid on its side on the other angle of the top plate to grind the top face of the tip.

A roughing and a finishing wheel may be used, one at each end of the grinder, and two combination slide plates provided, the tool being passed from one to the other. An alternative is a combination plate which can be lifted from its bed and dropped at the other wheel. If a chip breaker is required a diamond impregnated wheel is recommended, with the face and side meeting in a 1/16-in. radius. With this wheel at one end of the grinder for finishing, all operations may be roughed out on one end, and the most satisfactory finish obtained at the other.

Aircraft Generator Tester Provides Variable Speeds

A test stand providing an infinite number of speeds has been developed by U. S. Electrical Motors, Inc., 80 34th St., Brooklyn, N. Y., for testing aircraft generators, vacuum pumps,



hydraulic pumps, alternators and other accessories.

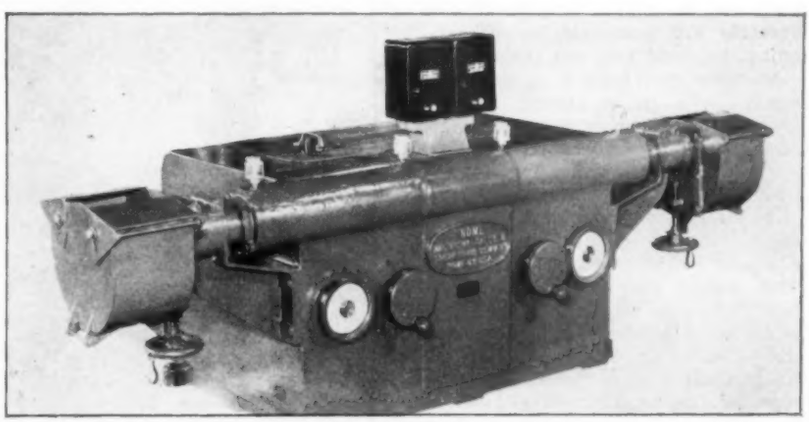
The device to be tested is rigidly aligned by locking it in place on the mounting bracket. This operation is quickly and easily accomplished. Positive speed changing is provided by a handwheel which changes takeoff shaft speed in accordance with testing requirements. A positively driven magneto generator and calibrated speed indicator accurately reveal test shaft speed.

Rome Polishing, Buffing and Grinding Lathe Features Independently Driven Wheel Spindles

Covering a wheel spindle speed range of from 1,800 to 7,000 r.p.m., the Model 2AS polishing, buffing and grinding lathe designed by Rome Machinery Sales & Engineering Co., 627-35 Webster St., Rome, N. Y., is equipped with wheel spindles independently driven through 3-hp. motors.

Each speed adjusting handwheel, conveniently operated from each wheel position, is combined with an automatic speed indicating dial. Arranged with 24-in. height from floor to spindle centers to permit operators to work on top of the wheels, this machine is adapted to the hand processing by grinding, polishing and buffing of a wide variety of products, such as cutlery, jewelry, hardware and miscellaneous small metal parts.

Drive mechanism is effectively inclosed and is accessible for servicing through a detachable door at the top of the motor compartment. Spindles run in special heavy-duty ball bearings which are assembled in dust-tight housings. Wheel guards are fabricated from heavy gage steel and are adjustable to compensate for

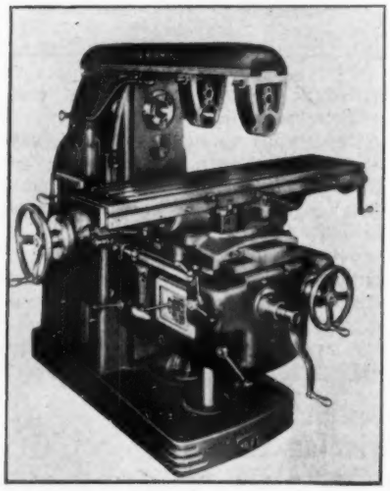


wheel wear. They may be pivoted around the wheel center to any convenient operating position. Weight of the unit, complete with motors and motor starters, is 2,400 lb.

Van Norman Miller Is Plain or Universal

A companion to the recently announced No. 2-L milling machine is the No. 2-S horizontal miller built by Van Norman Machine Tool Co., 160 Wilbraham Ave., Springfield, Mass. This miller is available in both plain and universal types.

Built and powered for maximum metal-removing capacity, it has 18 spindle speeds ranging from 25 to

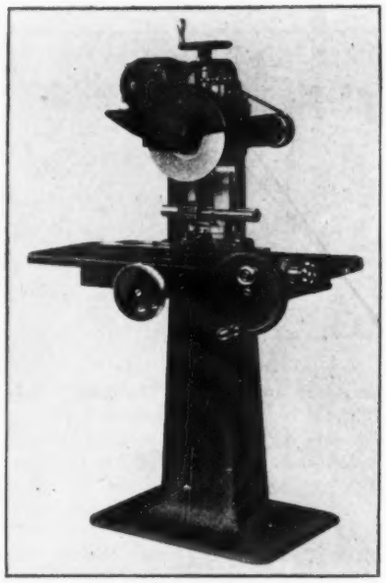


1,250 r.p.m., which are selected by a single lever, as are the 18 feeds which have directional control at both the front and rear. Power rapid traverse in all directions is provided. Machine is equipped with a 5x12-in. table.

Geometric Chaser Grinder Sharpens Chasers Only

To meet the demand for smooth, accurate threads in tough materials, Geometric Tool Co., New Haven, Conn., has developed the No. 20 chaser grinding machine which is built for the single purpose of accurately and economically resharpening die head and tap chasers.

Machine work table is mounted directly on a plane ground surface, and may be manually fed both longitudinally and transversely. A rapid feed is provided, while fine adjustments are possible by means of a micrometer handwheel. Spindle housing is pivotally mounted on a saddle equipped with three ground ways. This saddle may be adjusted vertically by an elevating handwheel, and after adjustment has been made the saddle can be securely locked in position. Final vertical adjustment of the grinding wheel is made by a small micrometer handwheel.



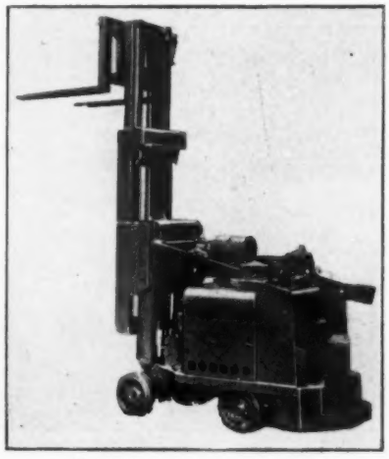
Spindle itself is equipped with a tapered bronze bearing at the front and a radial ball bearing at the rear. Adjustment for wear can be easily made.

Specifications: table travel, 8 in. longitudinal, 3¾ in. transverse; table working surface, 4x19 in.; distance from spindle center to table top, 13¼ in. maximum, 2½ in. minimum; motor, 1/3 hp.; floor space required, 44x32 in.; net weight complete with motor, 560 lb.

Elwell-Parker Fork Truck Lifts to Three Levels

Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio, has brought out a Type ERS-3T fork truck capable of elevating loads on skids or pallets to three levels instead of one.

Elevating mechanism is built in three telescoping sections. When uprights are completely lowered, the forks just clear the floor. At the operator's will, forks can be raised to 59½ in. on the first lift, to 88½ in. on the second, and to 112 in. on the third. Rate of upward travel is 20



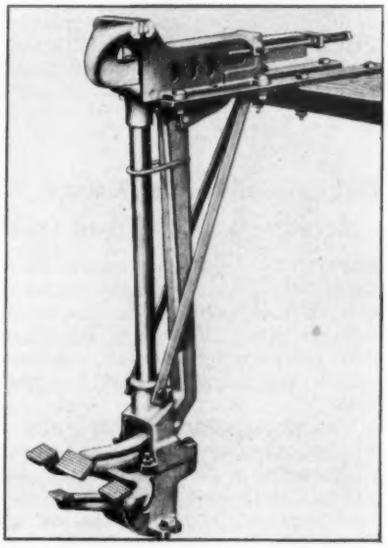
ft. per min., with a 1,500-lb load. With telescoping members lowered, overall height of the truck is but 74 in.

Main driving motor is 4-pole, series wound, capable of sustaining a 500 per cent overload. It is direct-connected to a free-coasting worm and gear, driving the two wheels nearest load, assuring ample traction. Power source can be either acid or alkaline storage batteries. No fuses are needed. When lowering load, regenerated power is returned to the battery. Hoist is operated by a separate motor controlled by pushbutton. It may be tilted 15 deg. backward or 5 deg. forward.

Hoist is provided with ratchet device which operates when the descending load meets an obstruction. A slip clutch serves the same purpose when ascending loads are obstructed. A solenoid brake locks the hoist load in any position. Fork arms are supplied in a variety of dimensions to suit application.

Automatic Vise and Clamp Leaves Both Hands Free

Both hands are left free for work with the automatic vise and clamping tool offered by Automatic Vise Sales Co., 2845 Sunset Place, Los Angeles, Calif. Free-sliding movable jaw is easily pushed with hand or



body against the work, and is then clamped and released with pedals. The main clamping pedal gives sufficient pressure for general work, while if additional pressure is desired an auxiliary pedal gives enough to hold practically any work. Releasing is accomplished by either of two side pedals. All pedals operate with little effort. A simple adjustment permits the device to be set for repetitive work.

All vital parts are made of case-hardened steel. Two types of mounting are available—directly on the

Announced Sept. 3rd—Thousands already in Use!

Industry rapidly adopts

NEW...CARBOLOY STANDARD TOOLS FOR "UNIVERSAL" SHOP USE ON 80% OF ALL TURNING, BORING, FACING JOBS!

Detroit, Sept. 3.—Mass production on a standardized line of Carboloy tools, designed to cover 80 per cent of all applications for cemented carbide tools, was announced by Carboloy Company, Inc., today.

The introduction of this simplified line of tools—comprising but five styles in three different grades—together with the economies resulting from mass production, has made it possible to price these complete tools well below comparable tools in the past, a typical new 'standard' tool, Style 4, now priced at only $1.85, comparing with tools previously costing $5.84 in lots of one. In quantities of 50 or more this typical tool now costs only $.90.

The program that has made this unprecedented step possible has been under development for the past three years. In the period from 1929 to 1937 prices of Carboloy cemented carbide

Style No. 1—Standard Tool
Available in 9 sizes

were progressively reduced four times as the result of economies resulting from increased consumption. About that time it became apparent that to widen the scope of useability of Carboloy tools required a complete revision of the principles under which such tools had been produced and sold up to then. What was needed was mass production of complete carbide tools on a scale never before attempted in this country.

Since 1937 extensive research work in the laboratory and in the field has been devoted to determining the fewest number of 'grades' of Carboloy and the simplest line of tools that would meet the vast majority of all carbide tool applications.

New $1,000,000 Plant Part of Program

Early in 1938 this development work had progressed to a point where Carboloy Company could proceed

Style No. 4—Standard Tool
Available in 9 sizes, left and right hand

with its next step—the expenditure of a million dollars on a new plant and equipment to expand and concentrate manufacturing activities. This plant, completed in the spring of 1939, was designed with a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount.

Since that time, research and field experimental work has resulted in reducing the number of grades of Carboloy required for the vast majority of applications to only three —one new grade for steel cutting, and two for cast iron. Further, it was found that five styles of tools in each of these grades would cover 80 to 90 per cent of all turning, boring and facing applications.

The basic design of these tools is

Style No. 13—Standard Tool
Available in 5 sizes, left and right hand

such that several hundred variations can be rapidly ground in the tools by the user to meet special requirements. With the fast, simple grinding procedure developed during the past five years and now widely used by industry, such tool changes can be rapidly and economically accomplished. This rapid grinding procedure, plus the fact that the price of these new standard tools is comparable to that of many ordinary tools, brings to the field of Carboloy tool use a flexibility that permits broad 'universal' use of these tools within the average shop on short job-lot work as well as production runs.

The new standardized tools are carried in stock, ready for shipment, completely ground and ready for use. An extremely valuable feature is the incorporation of a ground-in chip breaker on all standard tools designed for the machining of steel, at no additional charge.

The new program, according to the announcement, is anticipated to produce a wider scale use of carbide tools, thereby reducing the cost of production of basic cemented carbides to [illegible] that in spite of higher [illegible] cost.

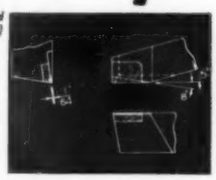
Carboloy Announces 6th Price R[illegible]

Since the year when Carboloy tools were first introduced it has been [illegible] of Carboloy Co[illegible]

For a number [illegible] have realized tha[illegible] reducing the [illegible] lev[illegible]

- ✓ LOW PRICED! *(Check against any other cutting tools)*
- ✓ SIMPLIFIED ORDERING!
- ✓ SIMPLIFIED TOOL STOCKS!
- ✓ IMMEDIATE SHIPMENT!
- ✓ YOU GET THEM ALL GROUND READY FOR USE!

(Steel cutting tools furnished with ground-in chip breaker)



Example of chip breaker ground in steel cutting tools.

Have You the Facts?

WRITE FOR CATALOG GT-125

CARBOLOY COMPANY, INC.
11149 E. 8 MILE ST., DETROIT, MICH.

Chicago • Cleveland • Newark • Pittsburgh • Philadelphia • Worcester, Mass. • Los Angeles
Canadian Distributor: Canadian General Electric Company, Ltd., Toronto

CARBOLOY
REG. U. S. PAT. OFFICE

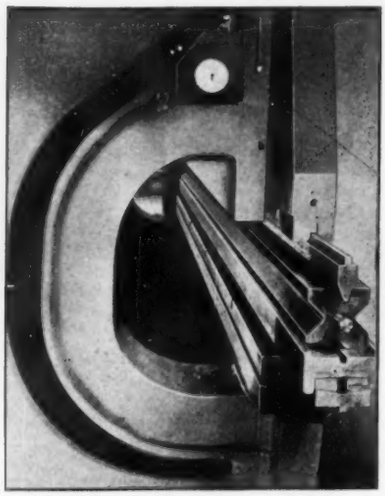
TANTALUM CARBIDES
TITANIUM CARBIDES
TUNGSTEN CARBIDES

bench or away from the bench, using steel strips as anchorage. The latter installation gives greater freedom to work on either side of the tool without bench interference.

Cleveland Tonnage Indicator Reveals Loads on Presses

A tonnage indicator for "Steelweld" bending presses has been developed by the Steelweld Machinery Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio. This indicator keeps both operator and management informed of the loadings to which the press is subjected. It gives warning when dies are worn, and tells when the press is being over-bottomed.

The indicator has two pointers, the



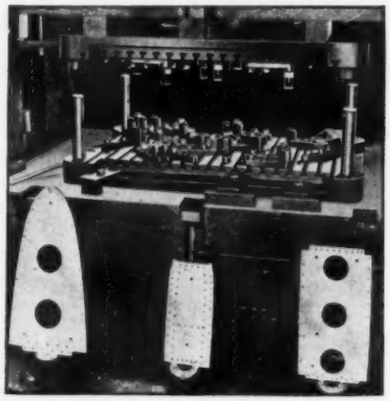
"job" pointer which registers tonnage for the individual job, and the "maximum load" pointer which indicates the maximum load at which the press has ever been operated. The job pointer remains at the highest tonnage reading developed by any of the operations of the job. It may be reset to zero reading at any time. Once set, the indicator requires no further adjustment. A cover that can be locked prevents unauthorized persons from tampering with the device.

Adjustable Die Sets Cut Production Time

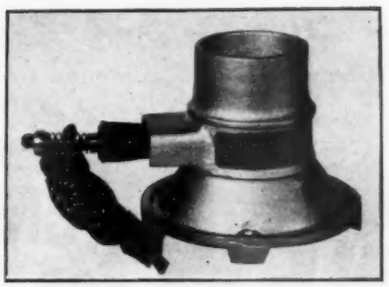
A great aid in reducing time required to get into production and at the same time answering the problem for economical dies for perforating and notching sheet metal is claimed for the universal adjustable die sets offered by S. B. Whistler & Sons, Inc., Buffalo, N. Y. Made in various sizes, these die sets permit much closer grouping of punches and strippers than possible by other methods.

Once in the possession of the user, these adjustable die sets may be rearranged as often as desired. Various sizes of punches for perforating and notching can be arranged in different positions to suit the job in hand. Even a difficult arrangement may be completed and press operations started within a matter of hours. Set-ups can be made by the operator while the die set is right on the press.

Being available in stock sizes from



0 to 1½ in., most punching arrangements can be made up with little loss of time. Because of compact design, press operations are reduced to a minimum through close grouping of large number of dies in a given area. In the foreground of the illustration are several airplane parts perforated on these universal adjustable die sets.



"Esico" Solder Pots Made for Fast Dipping

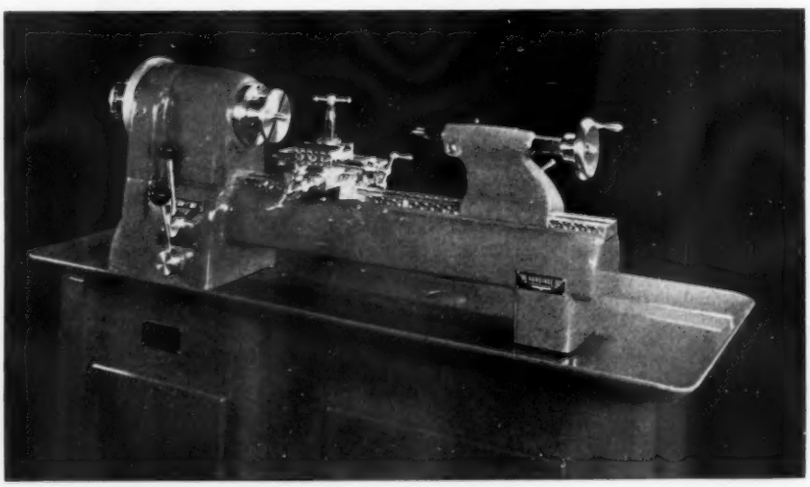
A line of "Esico" solder pots developed by Electric Soldering Iron Co., Deep River, Conn., has been especially developed for production jobs where fast dipping of parts is required. Claimed to be highly efficient from a heating standpoint, these pots incorporate a pilot light which indicates when the heating unit is in operation. Should the element or the power supply fail, this light will immediately indicate the fact, making possible prompt correction of the difficulty before production is affected.

These units are ruggedly constructed and are not top-heavy. They may be screwed to benches where there is a possibility of their being hit or jarred. They are available for use on both 115 and 230 volts, in wattages from 200 to 450. Capacities range from ¾ to 6¼ lb.

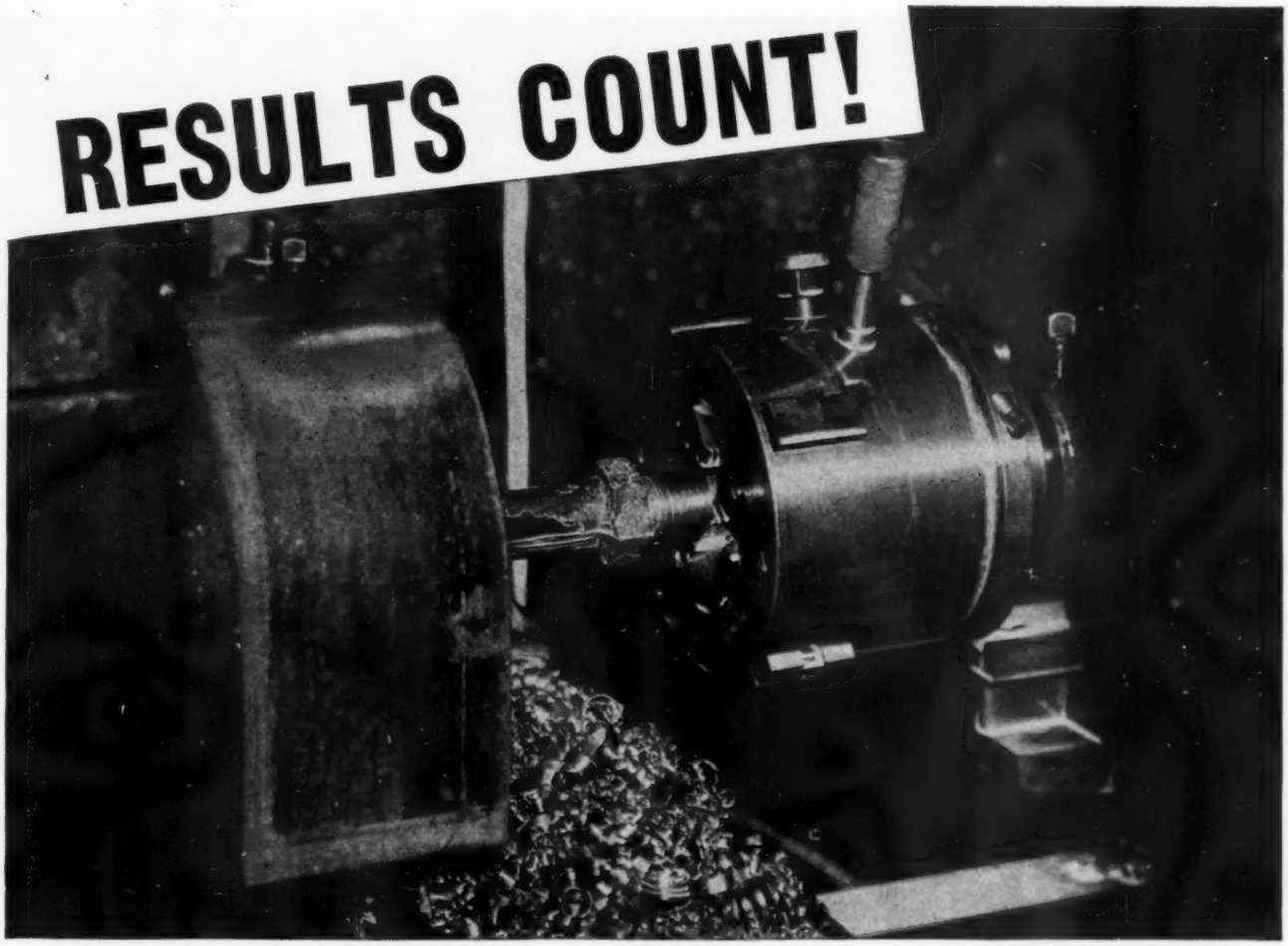
Hardinge High-Speed Precision Lathe Designed for Simplicity of Operation

Hardinge Brothers, Inc., Elmira, N. Y., has introduced a line of high-speed precision bench lathes which combine rugged construction with simplicity of design. Features include an inclosed head with preloaded ball-bearing spindle, an electrical driving unit with a multi-speed motor which eliminates all gears, clutches and pulleys, and a lever speed control at the headstock.

Amply proportioned machine bed rests on three spheres for perfect three-point suspension. Headstock bearings are fully inclosed in an inner chamber. Rear of the spindle carries a double pulley for V-belts from the driving unit. These belts may be changed without removing headstock spindle or bearing. The compound slide rest has large bevel dials. Tailstock spindle retains full



RESULTS COUNT!



"Excellent results for over five years have proved the value of Cities Service Cutting Oils in all of our operations, including threading, tapping and drilling," writes the purchasing director of a large electrical manufacturing company.*

This is but one of many examples where Cities Service Metal Cutting Lubricants have justified the title, "Service Proved."

We will welcome an opportunity to tell you more about them and about our Lubrication Engineers' Service. Just fill out the coupon below and mail it for further information.

Copies of our booklet, "Metal Cutting Lubrication" are still available to users of metal cutting lubricants. Write for your copy today before the supply is exhausted.

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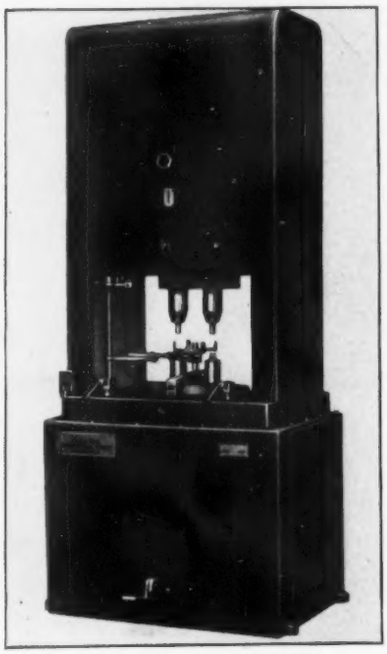
bearing in any position and has a precision ball-bearing to absorb thrust. A metal chart shows which of the eight speeds from 230 to 3,000 r.p.m. is being delivered by the driving unit.

Welded steel pedestal completely incloses motor and driving mechanism to afford greater safety and protection from dirt. Ample cabinet storage space is provided. This lathe is offered in five sizes up to 1-in. collet capacity and 9-in. swing.

Hanna Riveting Press Requires Little Floor Space

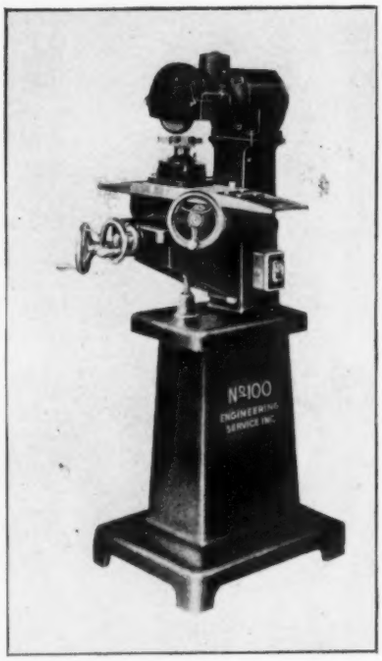
The latest addition to the line of electric-hydraulic riveting presses offered by Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has



been designed to occupy a minimum of floor space. In these presses, available in capacities ranging from 10 to 100 tons, motor, pump, controls, piping, cylinder and reservoir are totally inclosed, permitting the motor to be of the open frame type and resulting in an exceptionally clean design. Accessibility is provided through easily removable front, rear and side panels. Entire machine can be lifted out of its base without disturbing any hydraulic, electrical or mechanical elements.

From one to six or more rivets may be driven simultaneously, with equal pressure exerted on each rivet regardless of variations in length, hardness or grip. Omission of one or more rivets will not damage work or machine. Work assembly, loading, aligning, clamping and rivet nesting features may be built into the unit. Work is illuminated by built-in lamps.

Tonnage adjustment and gage are directly before the operator's eyes, as is the oil level sight glass. Driving dies may be either above or below. A complete riveting stroke of all dies can be accomplished in less than two seconds regardless of set-up.



Chip Breaker Grinder Sharpens Carbide Tools

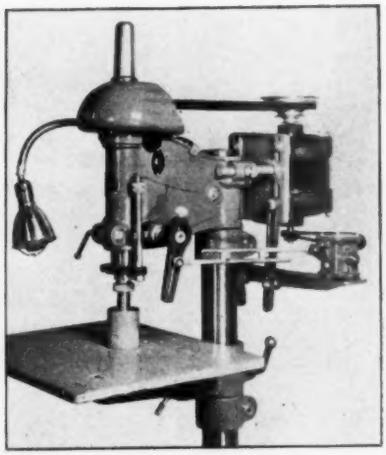
The "Strickland" precision chip breaker grinder developed by Engineering Service, Inc., Box 44, Huntington Park, Calif., has been designed especially for precision diamond wheel grinding of carbide cutting tool chip breakers. When equipped with the "Strickland" universal quick setting ball joint vise, this machine permits grinding all angles of the cutting tool at one set-up.

Both vertical and traverse adjustments of the grinder are precision controlled by graduated handwheels. Reciprocating longitudinal movement is controlled by a rocking motion of the handwheel. Machine is provided with a coolant reservoir and regulating valve to maintain constantly the proper degree of moisture on the diamond wheel. Ball-bearing wheel spindle runs at 3,450 r.p.m., providing correct cutting speed for a 6-in. diamond wheel.

Specifications: longitudinal table travel, 12 in.; transverse table travel, 6 in.; vertical movement, 5½ in.; working surface of table, 5x12 in.; motor, ½ hp.; net weight, 450 lb.

"Reciproc" Oscilling Mechanism Improves Drill Press Operation

When used for drum sanding or die grinding, operation of any drill press is claimed to be materially improved with the addition of the "Reciproc" oscillating mechanism developed by Specialty Machinery Co., 5606 Euclid



Ave., Cleveland, Ohio. This device provides the sanding drum with the longitudinal motion necessary to achieve a satin-smooth finish which requires no subsequent handwork. The device is claimed to function equally well whether processing wood, plastics or metal.

Mechanism fits any standard commercial drill press. It consists of a gear reduction unit mounted on a universally adjustable bracket which in turn bolts onto the drill press motor bracket. A gear reducer is driven by a belt from the lower idle motor shaft. The low-speed shaft of the reducer carries a crank arm to which it attached an adjustable connecting rod. This connecting rod actuates a rocker arm which is clamped on the spindle feed shaft. With a 1,740-r.p.m. motor, the device provides the drill press spindle with 100 complete strokes per minute. Stroke is adjustable to any length between ¼ and ⅞ in. Mechanism is mounted on a drill press in a few minutes, and once installed need not be removed as it does not interfere with other drill press operations.

Ball-Bearing Sensitive Drill Developed by Langelier Mfg.

Built to precision limits, the No. 41 ball-bearing sensitive drill has been made available by Langelier Mfg. Co., Providence, R. I.

Extra large sealed bearings requiring no additional lubrication are used on the sleeve carrying the driving pulley, and also on the spindle end to take the drill thrust. This spindle mounting eliminates belt pull and thereby makes the feed very sensitive. Feed lever may be adjusted to several different positions with operating rack and pinion protected by a guard.

For drilling to a fixed depth, a coarse setting is made using a stop rod, then the final micrometer adjustment is obtained with a depth stop screw which has a fine thread and is checked in position. Additional features include adjustable motor bracket, table and base with

Announcing... "SENIOR" PRESSES

BY COLONIAL

A line of low cost, general purpose hydraulic presses for assembling, broaching, etc. . . . 7 sizes . . . 1 to 10 tons capacity . . . 18 to 42 inch stroke . . . Open side table for working on long parts . . . Minimum floor space with motor mounted in column . . . Large amount of daylight for large fixtures . . . Direct driven high capacity hydraulic pump located within oil tank for maximum efficiency . . . Rugged construction throughout . . . Low priced through standardized design . . . Also available with special hydraulic circuit permitting use of 'shuttling' fixtures . . . *For details send for Bulletin VBS-40.*

"JUNIOR"
. . . Presses by Colonial available in ½ and 1 ton sizes for bench or pedestal operation. Bulletin VJ1-40.

COLONIAL BROACH CO. 147 Jos. Campau DETROIT

oli-retaining rims, and ball-bearing motor, complete with switch, cord and plug. A ¼-in. capacity chuck is applied. Bench, pedestal and gang models are available.

Furnace Pressure Controller Features Extreme Flexibility

Flexibility of installation, convenience of operation and ease of adjustment are stressed in a completely redesigned industrial furnace pressure controller announced by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

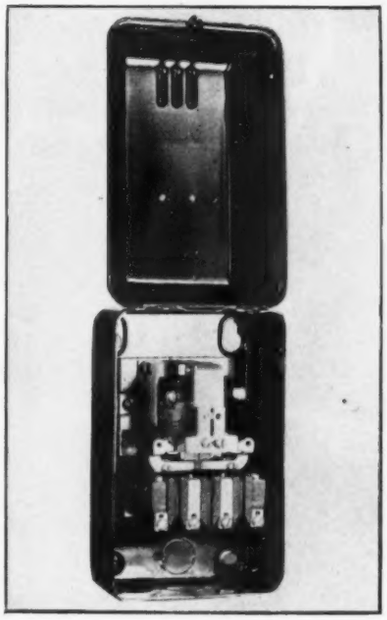
Mechanism is housed in a rigid, die-cast case. Although designed primarily for flush mounting, it can be supplied for surface mounting. Controller and related equipment can be panel mounted at the factory and shipped completely connected and wired.

Built into the controller door is a

selector switch and a pushbutton station. Integral parts of the instrument, these space-saving accessories enable the operator to take over on manual control at a moment's notice. Also located outside the door is a handy control setting knob. Through a window, just below it, can be seen a stationary pointer and a movable dial. A turn of the control setting knob rotates the dial and adjusts pressure as required.

Inclosed Type Contactor Handles up to 600 Kva.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has made available as a standard piece of apparatus an inclosed type DN multi-pole contactor. This Size 00 contactor is available in ratings up to 10 amp., 600 volts, a.c., and may contain as many as eight poles in any combination of normally open and normally



closed contacts required for the most complicated control systems.

Inclosure is made of black enamel sheet steel and has a deep drawn snap cover. Safety with accessibility to the contacts themselves is thus obtained. General shape of the inclosure conforms to that used on the standard line of Westinghouse-manual and magnetic "Line-Starters."

Pipe Cleaning Machine Has Hundred-Yard Range

Oster Mfg. Co., Cleveland, Ohio, has developed an electric sewer and pipe cleaning machine claimed to be capable of removing stoppages several hundred feet from the sewer or pipe opening, even when it is necessary to pass through elbows and traps. Revolving different types and stiffnesses of coiled wire "snakes" with various augers and cutting tools attached to them, the device is said to be very efficient in cutting through roots, rags, grease, chips, cinders and many other obstructions.

Machine is powered by a ½-hp. universal reversible variable-speed motor driving the spindle, through V-belts. A split pulley on the motor can be adjusted to lighten tension on the V-belts, allowing them to slip before the "snakes" become over-

strained in the event that an extra heavy construction is encountered. A gripping chuck which revolves the "snakes" eccentrically is mounted on the spindle. This eccentric action of the chuck gripping the "snakes" transmits a whip to the tool working in the line, enabling it to do a more thorough job.

Case and base of the machine are of fabricated sheet steel. Machine is mounted on casters large enough for easy rolling. Over-all length is 15 in., width is 15 in., and height is 4 in. Net weight is 85 lb.

Shop Cleaning Made Easier With Palmer-Shile Cart

A shop clean-up cart that functions like a dust pan on wheels has been announced by Palmer Shile Co., 7100 West Jefferson Ave., Detroit, Mich. This cart is said to outmode the wheelbarrow-and-shovel method in cleaning up accumulations of trash,

making an efficient job out of what is normally a puttering one. Mounted on ball bearing rubber-tired wheels, with a capacity of more than a bushel, the cart is easily handled and greatly simplifies the rubbish disposal problem.

Industrial Fluorescent Unit Permits Continuous Mounting

A twin lamp open and fluorescent fixture designed especially for general or supplementary continuous strip lighting in low bay industrial areas is offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These

Type FPC luminaires are available only in two-lamp spread distribution style, utilizing two 40-watt 48-in. fluorescent lamps.

Units consist of a hood, reflector, lamp holders, lamp starters, and ballast equipment. Fabricated sheet steel hood is hinged to reflector to provide easy access for making line connections. Reflector is white porcelain-enameled steel giving a high over-all efficiency with cut-off at 72½ deg. from vertical.

Twin ballast units and compensators provide high power factor, minimize cyclic flicker, and assure stable lamp performance. Luminaires are arranged for rigid or flexible conduit or chain suspension mounting. When used in continuous strip lighting, special end connecting bushings are furnished. These provide rigidity and provision for straight-through wiring. Although two supports are required when the fixture is used separately, only one support is required for all except the end fixtures when used in strip lighting.

"Oxbrite" Cleaning Process Improves Plating Results

The "Oxbrite" method of electro-cleaning brass, bronze and other copper alloys before electro-plating has been developed by Oakite Products, Inc., 22 Thames St., New York, N. Y. This process effectively removes foreign matter from work so that bright uniform electro-plated deposits are secured. The process also reduces cost by the elimination of the cyanide dip and copper strike before plating. In addition, it permits soft-soldered work to be bright plated without preliminary copper plating.

Another feature claimed for the method is the assurance of freedom from peeling of electro-plated deposits caused by inadequate surface preparation. Because it effectively removes all soap films and metallic deposits, and also prevents surface embrittlement, the method is said to provide much finer adhesion. Depending upon the relative amount of buffing compound used, and on the shape and other physical characteristics of the particular work, two alternate procedures for applying the process are available.

NEW MATERIALS

Enamels for Finishing Stoves Offered by Maas & Waldstein

A line of "Codur" enamels especially developed for use on stoves has been made available by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

These enamels can be supplied in white, porcelain white and colors. A single coat baked from 5 to 45 min., depending upon temperature and type of oven, produces a glossy finish

(Advertisement)

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel-service plants for prompt, stock shipment of steel to meet the current surge of business prompted by Washington's defense program.

Probably the leading exponent of "Immediate Steel" is Ryerson with a network of ten strategically-located plants each of which has large and complete stocks of steel and allied products. In addition, each plant is equipped with complete forming and cutting facilities so steel can be prepared to customer's exact requirements. No shop should be without the Ryerson Stock List (see advertisement below).

Thousands of manufacturers report saving considerable time, trouble and money by taking advantage of Ryerson's complete flame cutting service. Modern equipment manned by specially trained operators can quickly burn any shape—no matter how intricate—from carbon or alloy steel plates and billets up to 15" thick.

Ryerson Night Loading Assures Quicker Deliveries

It's after hours, at any of the ten Ryerson steel plants, almost any night of the year!

The Ryerson night shift is putting the finishing touches on *today's* orders; loading out the fleet of big, red Ryerson trucks for tomorrow's deliveries.

Immediate Steel is a Ryerson tradition. The entire Ryerson organization is geared up to handle *quickly* the steel requirements, simple or involved, of thousands of customers the country over. Special telephone order desks, hourly mail pick-ups at the post office, telegraph and teletype lines right into our offices—all help to speed delivery, even *before* the order reaches us.

Night loading to "clear the decks" for tomorrow's new crop of orders is the regular course of business. Every order is RUSH at Ryerson—most are shipped the day received.

Ryerson Steel Service is fast and sure; Ryerson Certified quality is your assurance of uniformity and exactness. Make the Ryerson Stock List your unfailing source for all steel requirements. If you haven't the 1940-41 Stock List we'll send one gladly.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

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"CINCINNATI" Milling Machine — Unit Type
All bearings in saddle unit Bijur-lubricated
The correct oil film to each individual bearing... automatically
make your product BETTER!

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which is said to be resistant to marring, hot grease and kerosene and which will withstand heating to 420 deg. F. for eight hours without noticeable discoloration. For more severe service, a special high-heat gloss enamel is available which will withstand 425 F. for twelve hours without objectionable discoloration.

An attractive and durable finish for heaters is achieved with "Duart" wrinkle enamel followed by a coat of "Metalustre" of any desired color. This type of finish will withstand 420 F. for 150 hours without darkening. A single coat of pigmented "Duart" wrinkle enamel can also be used.

"Swedish" Iron Powder Made in United States

Metals Refining Co., Div. of Glidden Co., Hammond, Ind., has begun production of iron powder which is claimed to be the equivalent of "Swedish" iron powder. Since the supply of iron powder from Sweden has recently been greatly reduced, this American-made product should prove of considerable value to the metalworking industry.

"Saty-Nite" Enamel Developed To Protect Hot Water Tanks

To commemorate the traditional bath night, Porcelain Enamel & Mfg. Co., Eastern & Pemco Aves., Baltimore, Md., has applied the name of "Saty-Nite" to a porcelain finish especially developed for hot water tanks. Tests indicate that this enamel triples the usefulness of even the best quality hot water tanks now on the market, affording greater protection against corrosion under severe conditions.

TRADE PUBLICATIONS

ALLOY STEEL Jessop Steel Co., Washington, Pa., has issued a six-page folder which describes "Truform", a non-shrinkable, oil hardening alloy steel for use in tools and dies where extreme accuracy is required.

ARC WELDERS A 144-page bulletin, "Lessons in Arc Welding," published by the Lincoln Electric Co., Cleveland, Ohio, contains over 100 illustrations and comprehensive practical information for arc welders.

BEARINGS Johnson Bronze Co., New Castle, Pa., is circulating three data sheets which describe the operation and construction of self-lubricating bearings.

CADMIUM PLATING A complete manual for operation and maintenance of cadium plating solutions is offered by E. I. du Pont de Nemours & Co., Wilmington, Del.

CAPACITORS General Electric Co., Schenectady, N. Y., is circulating Bulletin No. GEL-619 which describes how capacitors reduce feeder loading and improve low voltage conditions.

CONDENSERS General Electric Co., Bloomfield, N. J., has issued a 56-page booklet which describes condensing units from 5 to 60 hp. for both refrigeration and air conditioning installations.

ENGINES Bulletins Nos. S-500-B38, B-39, circulated by Worthington Pump & Machinery Corp., Harrison, N. J., provides a diagramed description of the construction and operation of diesel and convertible engines.

GRINDERS Gardner Machine Co., Beloit, Wis., has published an eight-page booklet which describes the construction and operation of surface grinders.

LAMPS General Electric Co., Cleveland, Ohio, offers Folder No. Y-0224 which describes the use of Mazda mercury lamps for use in industry.

MIXERS A four-page folder showing the various types and sizes of pneumix air-motored agitators is offered by Eclipse Air Brush Co., Inc., Newark, N. J.

PISTONS Aluminum Co. of America, Pittsburgh, Pa., offers Bulletin No. AD-34 which illustrates and describes the various types of pistons, materials and finishes.

PLASTIC MOLDING Crucible Steel Co. of America, New York, N. Y., has issued an eight-page folder which describes the method of selecting the right steel for plastic molding.

ROTOMILL National Broach & Machine Co., Detroit, Mich., is circulating a 16-page illustrated booklet which describes the application, operation, construction and specifications of Rotomills.

STANDARDS Aircraft Screw Products Co., Inc., Long Island City, N. Y., offers Bulletin No. T-1a, which contains engineering standards and technical information on the Aero-Thread screw thread system.

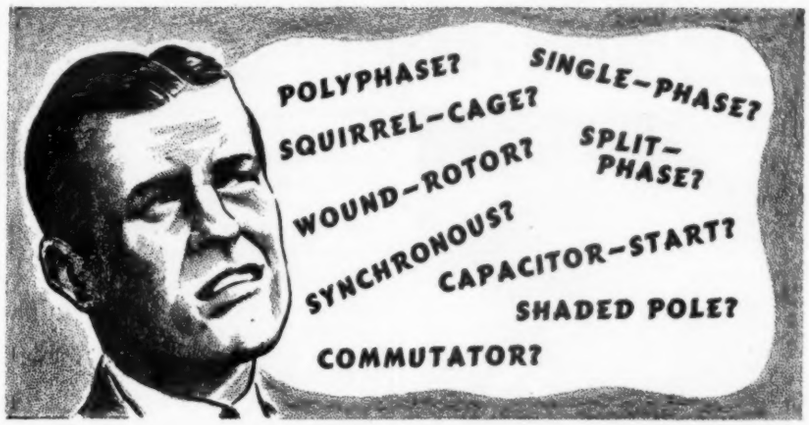
STEEL Joseph T. Ryerson & Son, Inc., Chicago, Ill., offers an eight-page bulletin describing the chemical analyses, working properties, and suggested applications of a wide range of cold finished steel bars.

WATER WHEELS Rodney Hunt Machine Co., Orange, Mass., has published a 124-page catalog, No. WW-40, which covers information on how to modernize water wheels for greater efficiency of operation.

SWITCHGEARS Catalog No. 1230, circulated by Roller-Smith Co., Beth-

WHY BE "IN A FOG"

ABOUT A-C MOTOR SELECTION?



LET GraybaR AID YOU IN FITTING MOTORS TO THE JOB

When you put your motor and motor-control problems up to GRAYBAR, you get a double assurance of sure performance: (1) GRAYBAR offers the complete line of *General Electric* motors and controls — backed by G-E research and manufacturing facilities — the line which GRAYBAR experience has proved of greatest value to its customers; (2) GRAYBAR representatives and specialists "on call" are prepared to assist you in choosing the right equipment for the job — service to you is their primary responsibility.

Whether you're selecting motors for plant motive power or types to be "built on" to equipment for resale — it will pay you to put your problem up to GRAYBAR.

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SPLIT-PHASE MOTORS for Fractional HP Service

For small power tools, pumps, fans, business machines and domestic devices, G-E split-phase motors offer many special advantages in the 1/60 to 1/3 h.p. range. Write GRAYBAR for new bulletin "Split-Phase Motors —Type KH" for full details.

FREE BOOKLET AIDS SELECTION

This free booklet, "How to Select A-C Motors and Control," contains nine factual articles on the special characteristics of different type motors, service factors, capacity ranges, etc. Write GRAYBAR for your copy.

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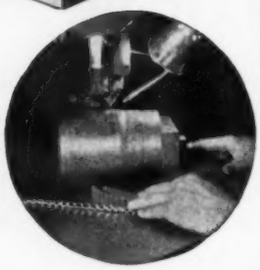
DoALL RELEASES OTHER MACHINE TOOLS ON URGENT DEFENSE JOBS



Chrome Vanadium Steel Part for hydraulic press: Made by Burndy Engineering Co., New York.

Former Milling time..... 13 hours
The DoAll removed sections shown in 37 minutes, reducing the finish milling to..... 2 hours

DoAll Savings on Milling...11 hours

The DoAll offers important short cuts in stepping up production. A great time and energy saver in cutting out internal and external shapes from any metal up to 10" thick.

Eliminates long hours of tedious hand work in making special tools and dies and in turning out short runs of metal parts.

This rugged precision machine tool is creating a sensation in 30 countries—in metal working plants, machine shops, arsenals, airplane factories, ship yards, etc.

Let a factory trained man bring a DoAll to your plant and show you what it can save on your own work.

FREE—New Handbook on Contour Machining—158 pages of valuable metal working helps.

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☐ Send data on the DoAll AM-10
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Name .....
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lehem, Pa., provides an 8-page pictorial description of the construction and operation of air circuit breaker switchgears which are suitable for the control of incoming lines, transformers and distribution facilities.

NEW BOOKS

ENGINEERING MECHANICS—SECOND EDITION—*By S. Timoshenko, professor of theoretical and applied mechanics and D. H. Young, associate professor of civil engineering, Stamford University. 553 pages. McGraw-Hill Book Company, 330 W. 42nd St., New York. $4.00.*

Formerly published as two volumes, this textbook on engineering mechanics has been edited and revised to fit between a single pair of covers. Some of the older sections are rewritten for shorter and simpler approach. Some of the longer and more academic problems have been deleted. In addition, several chapters have been dropped, and their essential contents distributed among other chapters as needed.

As in their original presentation, the authors have planned basic engineering approach to the subject of mechanics. They realize that specific problems are today changing so rapidly that routine use of formulas may prove of little value; instead they strive to establish an understanding of theoretical mechanics and the application of the fundamental principles. This emphasis on the general methods of attack is designed to build a strong foundation, rather than a drill in the use of standardized methods.

SEEN and HEARD

JOHN R. GODFREY

Infra-Red Drying

Ford attracted attention to the possibilities of heating and drying metal parts with incandescent lamps about two years ago. Radiant energy from banks of lamps were used to dry paint on car bodies. Plymouth used portable banks of lamps to furnish 250 F. for drying small areas of paint.

Experimental jobs, having up to 60 reflectors using 260-watt lamps are spotted around the country. (Ford now has about 30,000 reflectors installed in its own plant for complete drying of bodies and other uses). Some of the results show that this type of heating can make material improvement in production where lacquer drying or moisture drying is a problem.

Some successful applications in addition to lacquer drying include: softening of plastic sheets for forming and shearing, baking out armatures and motor coils, pre-heating various materials to improve absorption of varnishes, expanding or sweating one metal object to another, drying surfaces cleaned with water, drying glued joints. Enamel drying has not always been successful, nor was an attempt to dry sheet steel after pickling.

There are still many problems to be solved, but this method of heating offers much in the way of time and space saving, flexibility and portability. Heat is instantaneous at comparatively low cost.

Oil Pockets

Machine tools today are meeting heavier and heavier demands with consequent increased unit pressures on sliding surfaces. Any day in the week you can get an argument out of any two given designers by saying, "It is necessary to improve adjacent sliding surfaces by making them smoother and flatter." Or, if you prefer the other side of the argument you can say, "Milled or planed surfaces will stand up as long as any other provided there is proper mechanical fit, because the low spots serve as retainers for oil."

From then on words will fly thick and fast, and everybody will have a different idea depending on his experience. One of the things that makes wear a difficult subject is that there are so many variables and each industry has its collection of them.

Forgotten Arts

Hacksaws, like second-hand automobiles, are often used but never loved. As a matter of fact, there is a lot to the art which we never suspected until we talked to one of the manufactures of a completely automatic sawing-off machine. It is surprising how much difference there is in the rate of sawing different alloys and how the efficiency of hacksaws can be improved by the proper use of saw blade, cutting pressure and speeds.

Once you get a man interested in the technique of good sawing, you can accomplish a lot of things. One manufacturer is reported to have made savings of $12 to $14 on material by using proper technique with power hack saws. One employee who was given the job of running some automatic saws, became so enamoured with the job that at last reports he was locking every machine when he went out to lunch and when he quit in the evening so that nobody could tamper with them.

Auto Wrecks and Irrigation

Wrecked automobiles, welding outfits and mechanical ingenuity are the stock in trade of at least one small shop on the Florida peninsula. The owner, who is frequently the entire crew as well, has built up quite a business in building irrigation pumps

for growers of various vegetables. Wrecked cars supply the motor which is rebult where necessary. They also furnish universal joints for connecting the motor to the pump shaft, sometimes operating at a 30-deg. angle. In such cases two universals are used.

A sheet-steel tube, perhaps 10 or 12 in. in diameter and 15 ft. long, has a shaft centered in it by three equally spaced bolts. On the lower end is a sort of boat propeller made by welding blades direct to the shaft. The propeller end of this large tube is placed below the water level of the irrigation ditch and forces the water up the tube outside the shaft, and out the upper end, which is open. It's no job for any one but an old-time mechanic.

Productability

Too many coined words have "sound appeal" but mean very little. When they express an idea in one or two words they save time and are real additions to the language. One of the things machine users like to know is their ability to produce, in other words their "production ability" as one well known builder put it. It isn't an easy thing to rate, but "productability" seems to cover what we want to know. Productability depends on the material to be machined from the tools used, while in many cases the operator is the most important factor.

Setting standards for the productability of any machine is a man-sized job and depends largely on the kind of work. On roughing work it might be possible to use a "pounds-of-chips-per-hour" basis. On other work it would probably be better to set a comparative standard in pieces per hour on some well known machine and use that as a base. Or it might even be its net earning capacity per hour or hundred hours. By any standard productability is what counts in any machine.

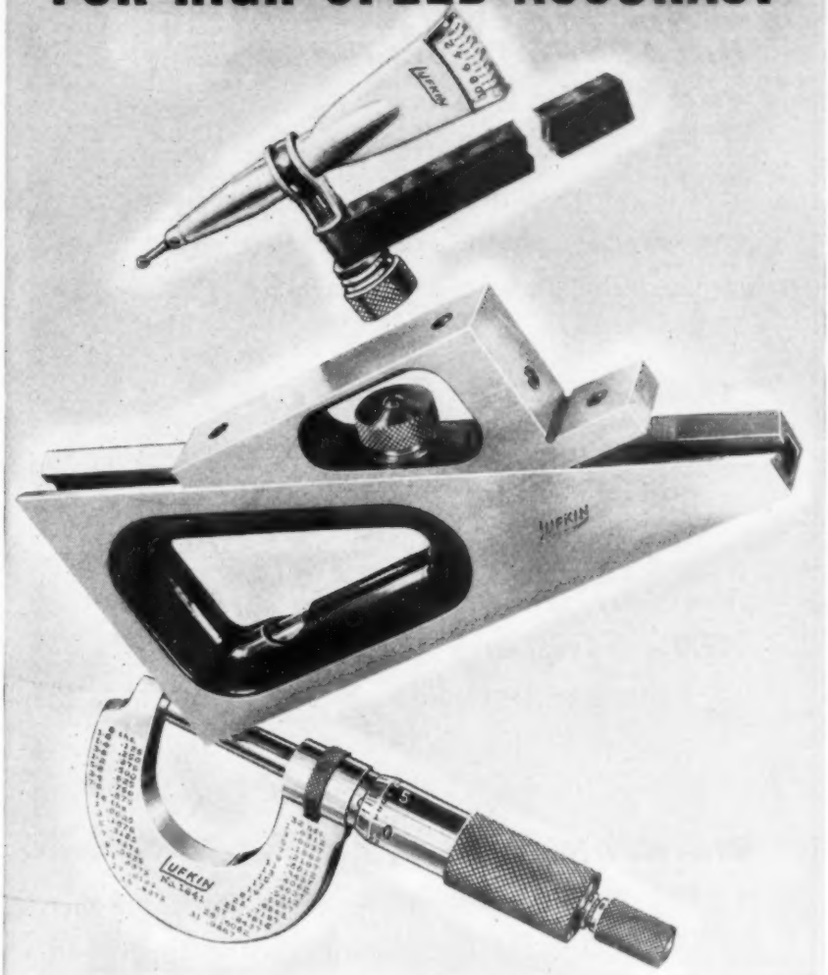
Old Cast Iron Learns New Tricks

While traveling about the country gathering advance information on the late lamented Machine Tool Show we found the phrase "cast iron" covered a multitude of mixtures.

A majority of the cast machine tool bases of today may contain anywhere from 30 per cent up to as much as 80 or 90 per cent steel, often steel rails. Rails are used because of the uniformity of the steel, its cleanliness and fairly narrow range of carbon content. The mixes may include silicon, nickel, chromium, or molybdenum, or combinations of these items, to provide a close grained, high strength iron. The composition depends on the size of section and chilling effects as well as required strength.

In one shaper the bed, saddle, cross slides and table are alternately steel

LUFKIN PRECISION TOOLS
FOR HIGH SPEED ACCURACY



Today, more than ever the demand is for precision tools that get the results. The CORRECT results — and get them fast! And that's where Lufkin comes in. Years and years of designing new precision tools, improving existing ones and manufacturing only according to the most rigid quality specifications have put into Lufkin products the very things that machinists most need today. It will pay you to look these outstanding tools over. Write for a free copy of catalog 12B.

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Hardening Cartridge Clips and Chain Links

Reciprocating Heating Machines in various sizes, with a full muffle for controlled atmosphere, or open hearth to produce a thin freely shedding scale, give uniform quality hardening.

Annealing Cartridge Cases

Rotary Retort Continuous Heating Machines with hopper feed to uniformly anneal brass cases in the various stages of manufacture.

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A cast link belt conveyor Heating Machine 3′ wide by 14′ long is proving itself highly satisfactory for this requirement.

Hardening Cartridge Cores

For .303 and .500 caliber cores, Rotary Retort Continuous Heating Machines with hopper feed and internal discharge are supplied in various sizes.

Gun Metal Finish

The deep black which penetrates to the bottom of blind tapped holes continues to be preferred on rifle and revolver parts. Rotary retort batch Heating Machines are successfully used for this requirement.

Representatives located in principal cities.

If you are quoting on any of the above, do not fail to get in touch with us.

American Gas Furnace Co.
Elizabeth, New Jersey

mix castings and steel mix plus nickel and chromium castings. Hardness of the two materials differs by about 80 points Brinnel, which is claimed sufficient to prevent galling and permits the effective use of scraped ways integral with the castings.

Lead, Pitch and Multiple Threads

Men whose chief acquaintance with screw threads is confined to bolts and nuts frequently use the terms "pitch" and "lead" interchangeably. But men who handle multiple threads *must* use the terms correctly or get into trouble, as one did recently.

Double and triple threads are not uncommon for rapid traverse of machine parts. But the lens barrels of candid cameras put these to shame in possibilities for error. Some recent examples were 9-15 pitch and 16-40 pitch, which in this case means a fifteen *pitch* thread with nine "starts" and a 40 pitch thread with sixteen "starts." The *leads* were 9/15 or 0.60 in. and 16/40 or 0.40 in. *lead*.

Making and using taps of this kind requires care in planning for chips as well as in relief and in centering in the work. On thin barrels it is advisable to tap the hole before turning the outside on account of the danger of swelling or spreading.

Redraw After Grinding

Dies should be redrawn after grinding to about 50 F. less than the original drawing temperature. This practice takes extra time in reconditioning the tool, but proves helpful in obtaining longer life between grinds. The redraw overcomes strains set up in grinding, particularly when the wheel is not maintained in the best condition, or is not exactly suited to the job. Removal of strains by this method does not impair the temper, but does minimize checking of the tool. Besides lengthening the time between grinds, the practice of redrawing the tool may save making another die plate in some instances.

Left-overs and Scrap Parts

Being able to find things in the shop saves a lot of annoyance as well as time and money. The large shop usually buys and keeps a large enough quantity of bolts, washers, cotters, rods and sheet or strip metal to have definite bins or racks where it can be found. But many small shops have only a little more than is needed for the job in hand and all too frequently mislay the left-overs. Then when one or more are needed for another job, the hunt begins. It would frequently be much cheaper to buy new ones than to waste the time in hunting. But this means going to the supply house, which means more

time wasted. The loss comes in waste of time and exasperation more than the actual cost.

For this reason it pays to spend enough time to start, and carry on, some system of bins or other storage facility, so that spare parts can be found. For small parts some find glass containers very satisfactory, as they show at a glance what is inside. Fruit jars with screw tops, either in pint or quart sizes, are often found convenient. Some fasten the cover to the under side of a shelf and screw the jar into it. This suspends the jar with the contents in plain sight. One advantage is that the jar can be removed and replaced with one hand. If several shelves are used space must be allowed for the hand under the jar. They can also be held at an angle if the space available makes this more convenient.

Whatever form of storage is used the main thing is to put left-over parts away at once so they can be found when wanted. Much time is frequently saved on important jobs if a few bolts or small parts can be found promptly. Metal bins are made which conserve space and keep parts free from dust. All hands must be trained to put "left-overs" where they belong, or this can be assigned to one of the boys as part of his job.

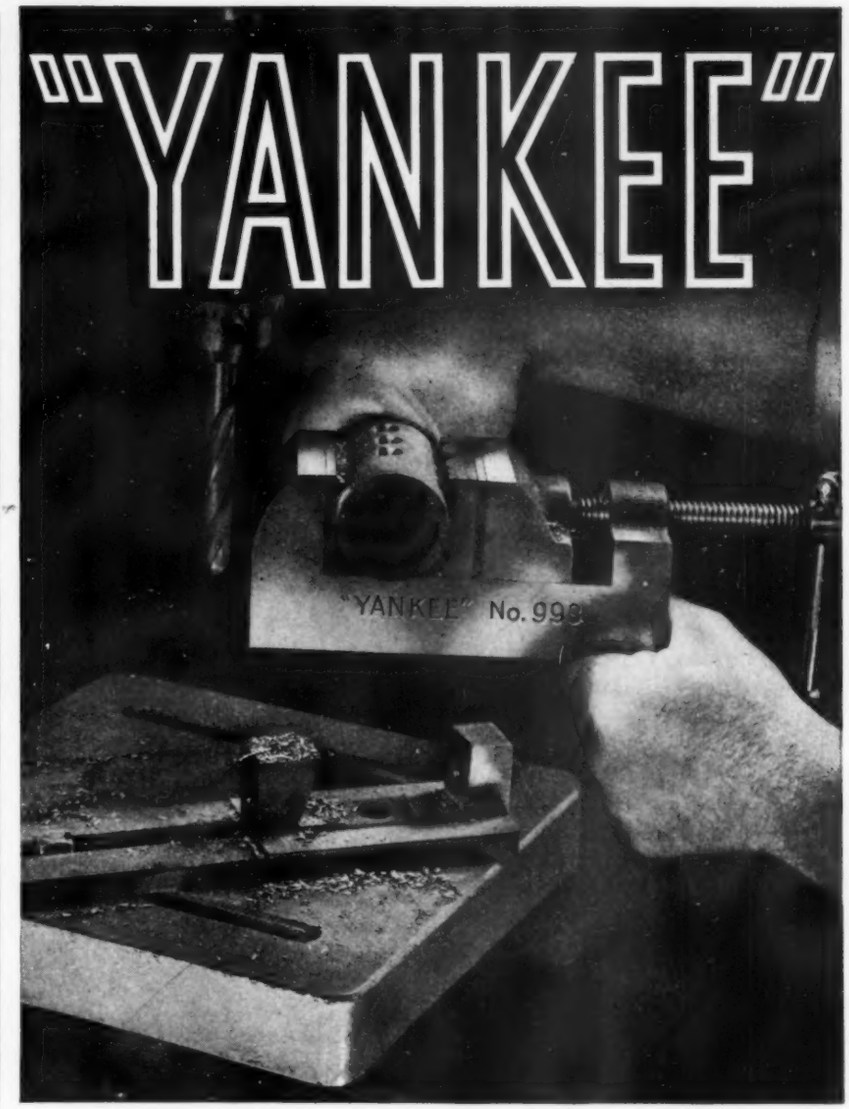
This also applies to small pieces of bar stock, to tubing, to sheet or strip metal and all other materials that are left from any sort of job. It is economy to save them if they are kept where they can be readily found, but it may be cheaper to throw them away than to waste a lot of time hunting for the piece needed. Nearly everyone saves odds and ends in the hope that they will be needed, but scrap piles that have to be pawed over may be a liability instead of an asset.

Keeping Machines Clean

By ED WEST

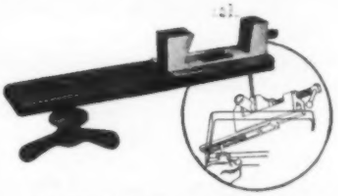
We are always picking up management ideas on how to keep shops clean. Here is a card which one manufacturer blueprints and places on every machine in his shop.

"Operator must report error or defects to the supervisor immediately upon discovery. Scrap due to carelessness will not be tolerated. Read blueprints carefully — check your tools—have the first piece checked by inspector in every instance—do not proceed until inspector has approved first piece. Machines must be kept clean and properly oiled. The use of hammers to set or loosen table or carriage locks on any machine is forbidden. Operators are responsible for the condition of machines on which they work. (We know of another shop which has a slogan tacked to every one of its machines to the effect, "If you are too good to keep this machine cleaned up, you are too good to work here.") Do not abuse



VISE and VISE CLAMP

"YANKEE" Vises and Vise Clamps are made to work together—for more accurate results in less time. Work can be kept in alignment for a series of jobs. The clamp holds Vise rigidly for machining operations. Its long slotted body makes for quick and easy adjustment of work on Drill Press table. Vise illustrated available in four sizes: No. 991; 1½" jaw width. No. 992; 2" jaw width. No. 993; 2¾" jaw width. No. 994; 4" jaw width. "Yankee" Vise Clamp made in two sizes only: Clamp No. 2992, length 9¾", for Vise No. 992. Clamp No. 2993, length, 10½", for Vise No. 993.



This "Yankee" Clamp easily attaches "Yankee" Vise to face plate. Assures rigidity and accuracy, in holding work for drilling and machining operations

ORDER FROM YOUR SUPPLY HOUSE. FOR "YANKEE" VISE CIRCULAR, WRITE NORTH BROS. MFG. CO., DEPT. AM, PHILADELPHIA, U.S.A.

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KEEP YOUR WELDING COSTS DOWN WITH MUREX

GENEX

The SPEEDY, EASY-TO-USE ALL-PURPOSE ELECTRODE FOR STRAIGHT POLARITY OR A. C. WELDING.

Designed for welding in any position... flat, vertical, or overhead...and to readily bridge gaps where assembly fit-up is imperfect, Murex Genex Electrodes have several outstanding features which make them highly economical in operation. They are used at higher currents, which steps up welding speed. They burn with less spatter; less smoke, and so provide better visibility of the arc and the molten pool of weld metal. The slag is easy to remove and does not cling to the edges of the weld, even on heavy fillets.

Send for complete information, or ask to have a representative call and show you what these electrodes can do.

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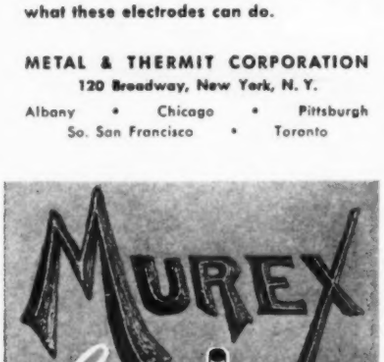

Investigate Thermit Welding, too—in use since 1902 for heavy repair work, crankshafts, etc.

machinery, jigs or equipment in any manner. Junk or refuse of any kind should not be allowed to accumulate in the vicinity where you are working. Avoid the use of air to blow chips off of work or machines, use a brush or wiping cloth. Clean the way cleaners of the machines at frequent intervals. Check the oil level on your hydraulic machinery before starting work and report drop in level to supervisor immediately. Don't lay tools, fixtures, or other pieces on the edges of tote pans, work benches or tool and supply boxes."

A Shop Secret

About 30 years ago I visited an auto shop in Reading, Pa., and was shown how they lapped the pistons into the cylinder bores. They had copied it from Rolls-Royce, only they had a secret abrasive. A little later a plant in Indianapolis showed me the same operation, with the same abrasive—also a secret. I next saw the same thing in a shop overhauling motors for the Speedway racing cars, which also included lapping the bearings, with the same abrasive. By this time it was no longer a secret; however, it was seldom used.

Only recently I visited a builder of machine tools who laps spindles into their bearings and gets a nice job. It's a special abrasive—the same as the others. But it isn't secret. It's hand Sapolio, that has a grit which breaks down and stops cutting after a few minutes. At least that's the story that I've been hearing for 30 years—and it does make a nice job.

Diamond Tools

The first extensive use of diamond tools which we can remember was in turning the barrels of fountain pens over 30 years ago. They had then been employed some time. The old Marmon plant in Indianapolis stands out as a pioneer in our recollection. We recall diamond boring bars for the main bearings in the crank case. The most unusual application at Marmon was a shaper tool with two diamonds for sizing the ends of the bearing caps to secure an accurate fit in the recess in the pillow block. That was the only application we ever saw on a reciprocating cut.

Public Relations for Presidents

We are thinking about starting a school of public speaking for company officials.

A few months ago we sat in the grandstand listening to the president of a large organization attempt to give a hearty, man-to-man talk to his employees. The build-up and introduction were swell, and we all sat back to hear some heartening words from the boss himself. He walked out on the stage, fumbled around in his pockets, finally hauled out two sheets of paper and read his talk to us. Maybe we're wrong, but it seems to us that he would have gotten lots better results if he had just stood up there, rambled on in a friendly way and let the boys know by his smile and his actions and a direct look in the eye that he was really glad to be there and sincerely glad that he was their boss.

Of course, there is the argument that the leaders of a company have more to do than to make friendly speeches to their employees. In these days of modern production and manufacturing methods, we're not so sure. Maybe companies should adopt the French system of electing as president of the company a man who can make the public appearances and do all the social duties of the job while in back of the scenes is a premier who runs the show.

Let George Do It

By B. HERMAN

A trait observed among machinists in some shops is the "let George do it" attitude. This probably makes for more riled tempers than any other factor. Especially is this true in shops where each man is obliged to carry through a job requiring the use of several machines. In a group of such men there is usually one patient George. Watch him as he goes about his work:

He has a lathe job to do. First there is the steady-rest some one used before and left standing on the machine. He takes this off and puts it in its place, and then begins to clean away the debris remaining on the lathe from several previous jobs. He carefully wipes and oils the ways, and shoots some oil where the machine needs it.

He finally puts the job in the chuck and takes a face cut, then goes for a couple of drills. In getting the drills from the cabinet, George knows without looking that they're dull, and maybe burned blue. He sharpens the drills, makes the holes, and must now mount the work between centers. But he finds the center points have been scored since he last ground them off, so he regrinds them. He now has the work turning between centers, takes a cautious cut and, just as he suspected, the tailstock has been carelessly lined up and the lathe is cutting a taper. He trues up the centers and finally gets his lathe work finished. After cleaning the machine spick and span again, he picks up his drills and several other drills and reamers left lying around by others and replaces them in the cabinet.

Poor George? No. Poor shop.

5
REMARKABLE ADVANTAGES OF
*AIRKOOL
DIE STEEL

1. *Readily Machinable*
2. *Air Hardening*
3. *Non-Deforming*
4. *T-o-u-g-h*
5. *Wear Resisting*

AIRKOOL DIE, 10½" x 8¾" x 1⅜", which blanked out an initial run of 25,000 cogs from .078" thick half hard Cold Rolled Strip and is still in excellent condition. This design and application required a die steel with exceptional toughness. This tough AIRKOOL die after heat treatment did not change as much as .001" in any dimension.

COLLAPSIBLE TAP BODY OF AIRKOOL, 10½" diam. 8" thick. Weight 25 lbs. AIRKOOL chosen because its deeper hardening gave greater wear resistance on the bearing surfaces. Size change and distortion was less than .001" per inch, an 80% improvement over the case carburized steel formerly used, effecting remarkable savings in costly grinding and lapping.

Toolmakers and machinists like to work with AIRKOOL because it's readily machinable. That means faster work . . lower costs . . to start with.

Then the heat treaters simply harden AIRKOOL in air from 1750°F. to 1850°F. and temper to the desired hardness . . from Rockwell C 58 to 64. That's simple enough.

Negligible-Size Change

But the important thing about the hardening and tempering of AIRKOOL is that users find the size change is practically negligible. The expense of machine and hand work for dies, punches, rolls, important machine parts and the like is perfectly safe when working with AIRKOOL . . and that's a property that saves plenty for you!

Outstanding Toughness

On the actual work, AIRKOOL proves to users that it is t-o-u-g-h . . able to stand up under the quickly repeated shocks of quantity production . . far t-o-u-g-h-e-r than other alloy die steels.

And finally, AIRKOOL has a remarkable record of resistance to abrasive wear . . users report much more than 100% increase in production . . some as high as 200%.

Call Crucible's nearby Branch Office for further information on AIRKOOL . . or write for the AIRKOOL booklet TS200.

HIGH SPEED TOOL STAINLESS CRUCIBLE'S *Full-Range* SPECIALTY STEEL SERVICE ALLOY PRODUCTION SPECIAL PURPOSE "CALL ON CRUCIBLE" *Your Centralized Source of all Specialty Steels*

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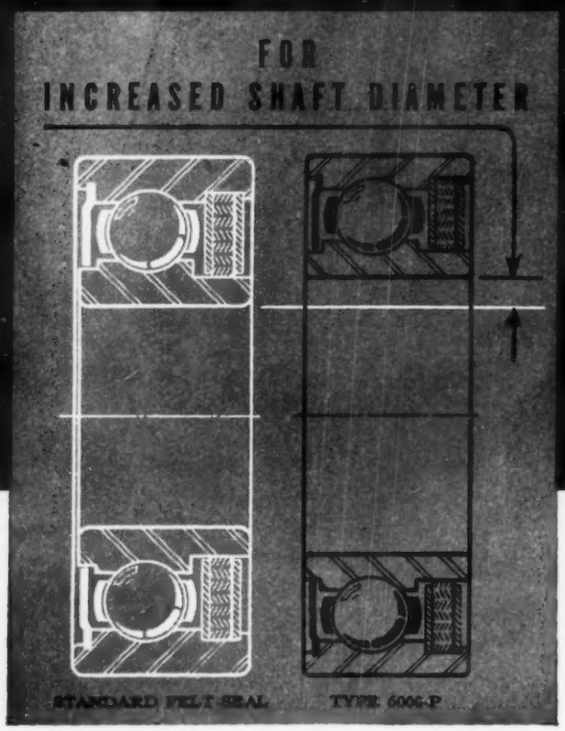
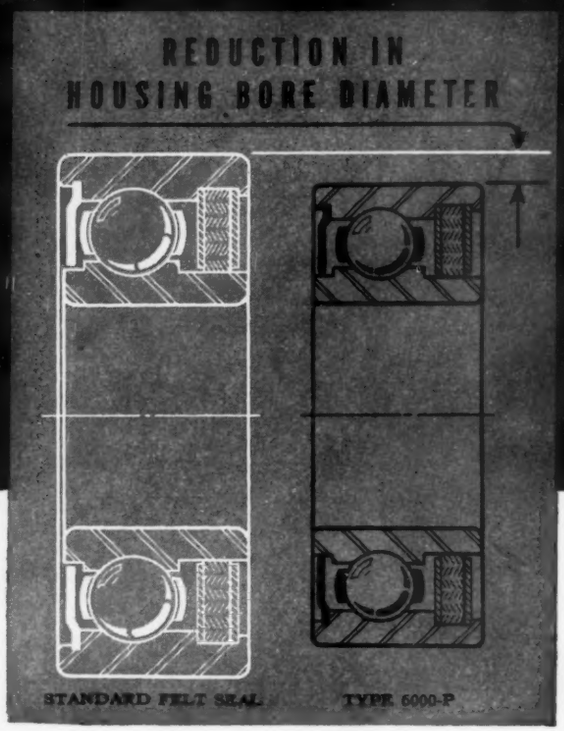
EXTRA LIGHT FELT SEAL BALL BEARING





This NORMA-HOFFMANN "6000" SERIES BALL BEARING meets the needs of manufacturers of portable tools and other small high-speed units in which minimum weight is sought, center distances are restricted, and designers are cramped for space.

From the illustrations, note that the lighter proportions of the new "6000" Series permit a larger shaft in a housing of fixed diameter, or a smaller housing for a shaft of given diameter, than any standard light series felt seal bearing.

Observe also that the thick, closely-fitting, removable (Patented) felt seal is wholly within the confines of the bearing itself and therefore not exposed to injury. The wide, solid inner and outer rings make housing inserts unnecessary. Grease capacity is ample for long periods of service.

Let our engineers work with you.

BEARING NUMBER		BORE		OUTSIDE DIAMETER		WIDTH
6000 Series	6000-P Series	MM.	Inches	MM.	Inches	Inches
6010	6010-P	10	.3937	26	1.0236	.453
6012	6012-P	12	.4724	28	1.1024	.453
6013	6013-P	13	.5118	28	1.1024	.453
6015	6015-P	15	.5906	32	1.2598	.500
6016	6016-P	16	.6299	32	1.2598	.500
6017	6017-P	17	.6693	35	1.3780	.500
6020	6020-P	20	.7874	42	1.6535	.563
6025	6025-P	25	.9843	47	1.8504	.563

The "6000" series is furnished with single felt seal and the "6000-P" series with felt seal and metal shield to the dimensions shown in the table to the left; available also are "6100" (unshielded), "6100-P" (with one metal shield) and "6100-PP" (with two metal shields) series which are slightly narrower in width. Write for data sheet.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

YES, A SOLUBLE OIL THAT GIVES RUST PROTECTION

● A LARGE Illinois machine manufacturer doesn't leave anything to chance in buying materials and supplies. An adequately equipped laboratory is maintained to test all products used.

Recently various soluble oils were put through their paces at this plant. Superla Soluble Oil was one of them. Here are the results:

Superla gave adequate rust protection, even in lean mixtures.

Superla gave a highly satisfactory finish on both machining and grinding operations.

Superla cost 12% less than the next most economical oil when all factors were considered.

Even though you may not have elaborate laboratory facilities, you can still test Superla. A Standard Oil Engineer will help you. Put it on some job in your shop. See for yourself how finishes brighten, how tool life jumps and how Superla actually protects you against rusting of finished parts. Call the local Standard Oil (Indiana) office, or write 910 So. Michigan Ave., Chicago, Ill. Just say you'd like to have a Lubrication Engineer make a test of Superla for you.

Copr. 1940, Standard Oil Co. (Ind.)

SUPERLA
SOLUBLE OIL

STANDARD OIL COMPANY (INDIANA)

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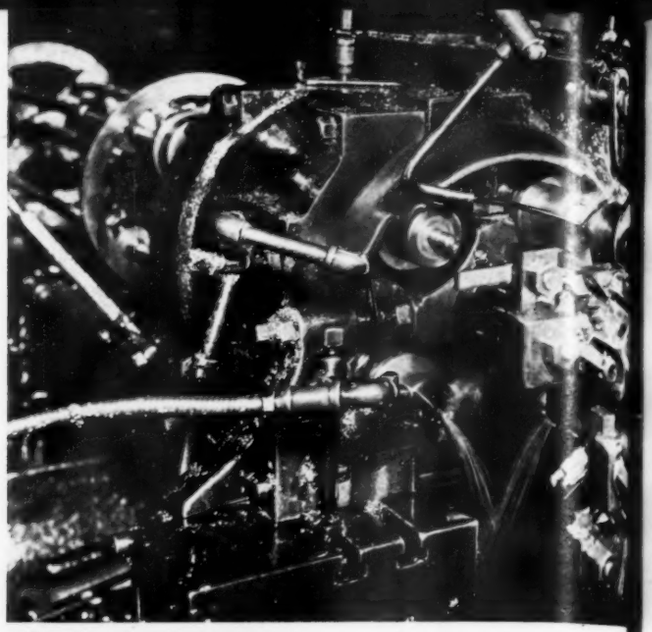
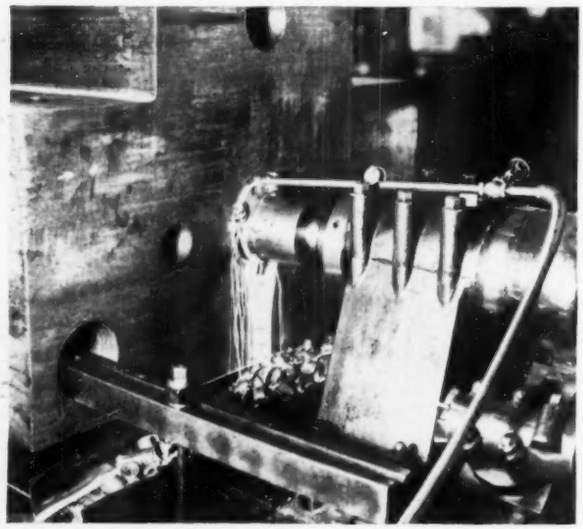


8-INCH HOLES—5 FEET DEEP—IN STEEL, YET TOOLS KEEP COOL WITH . . .

SUPERLA SOLUBLE OIL

When a Michigan heavy machinery manufacturer was asked to try Superla Soluble Oil he gave it one of the toughest jobs in the shop, boring 8-inch and 11-inch diameter holes, up to 5 feet deep, in steel billets. But Superla handled it without the slightest trouble. Boring tools ran cool and stayed sharp. Gummy deposits in this machine had been very troublesome. Although Superla was used in a 25 to 1 mix, there was no sign of gumming.

Then Superla was tried on other operations; drilling,



milling and screw machines. In all cases cutting time was reduced and speeds and feeds increased.

In addition, Superla Soluble Oil emulsifies readily in hard or soft water, without requiring special mixing equipment. The emulsion also is stable and will not separate even after long periods of use.

If you have avoided using soluble oils for certain types of machining because you have had trouble getting stable emulsions without separation or gum formation in machines, let a Standard Oil Engineer show you how you can avoid these difficulties and still take advantage of soluble oil low cost with Superla.

ACME CUTTING OIL REDUCED OUR OIL COSTS 10%

Let J. P. Atkinson of the Hoyt Machine Company, Indianapolis, give you his three reasons for using Acme Cutting Oil.

He writes: "We have been using your Acme Cutting Oil No. 110 for some time with very gratifying results. We are able to secure very fine finishes . . . We are operating our machines at high speeds and the oil seems to dissipate the heat very rapidly . . . We believe it has reduced our oil costs approximately 10%."

A Standard Oil Engineer can give you a lot more reasons for changing to Acme. Better still, he'll pick the right grade of Acme for some job in your shop and help you make a test. You'll have your own reasons for changing to Acme.

STANORUST PROTECTS EXPORT SHIPMENTS

Shipments of machinery protected with Stanorust have been made as far as Beria, East Africa, requiring seven months en route, and to many points in South America without one complaint from a customer because of rusted parts.

The customer, a Michigan pump manufacturer, reporting this experience, also finds that Stanorust "is easy to apply with a brush"—"it does not rub off easily or run in warm weather." You'll also find that with the right grade for the job you'll need less Stanorust to get full protection against rusting even under severe conditions.

Why not put your rust protection problems up to a Standard Oil Engineer? He'll test Stanorust for you. See what it does on your job.

HERE'S WHERE YOU'LL FIND STANDARD OIL ENGINEERS . . .

Billings, Montana	Fargo, North Dakota	Mason City, Iowa
Chicago, Illinois	Grand Rapids, Michigan	Milwaukee, Wisconsin
Davenport, Iowa	Green Bay, Wisconsin	Minneapolis, Minn.
Decatur, Illinois	Huron, South Dakota	Peoria, Illinois
Denver, Colorado	Indianapolis, Indiana	Quincy, Illinois
Des Moines, Iowa	Joliet, Illinois	Saginaw, Michigan
Detroit, Michigan	Kansas City, Missouri	St. Joseph, Missouri
Duluth, Minnesota	LaCrosse, Wisconsin	St. Louis, Missouri
Evansville, Indiana	Mankato, Minnesota	South Bend, Indiana

There's a specially trained Lubrication Engineer located in each of the cities shown in the list at the left. A card or phone call to the Standard Oil (Indiana) office will bring one of these engineers to your plant. He'll be glad to discuss your lubricating problems, make cost-saving suggestions in methods of application and types of lubricants or cutting oils, all at no cost to you. You can also reach your Standard Oil Engineer by writing 910 So. Michigan Ave., Chicago, Illinois. In Nebraska, call or write Standard Oil Company of Nebraska at Omaha.

"THE WHEELS OF INDUSTRY"

• STERLING ABRASIVES •

THE
STERLING GRINDING WHEEL CO.
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

Trained operators, working swiftly, produce uniformly high quality welds

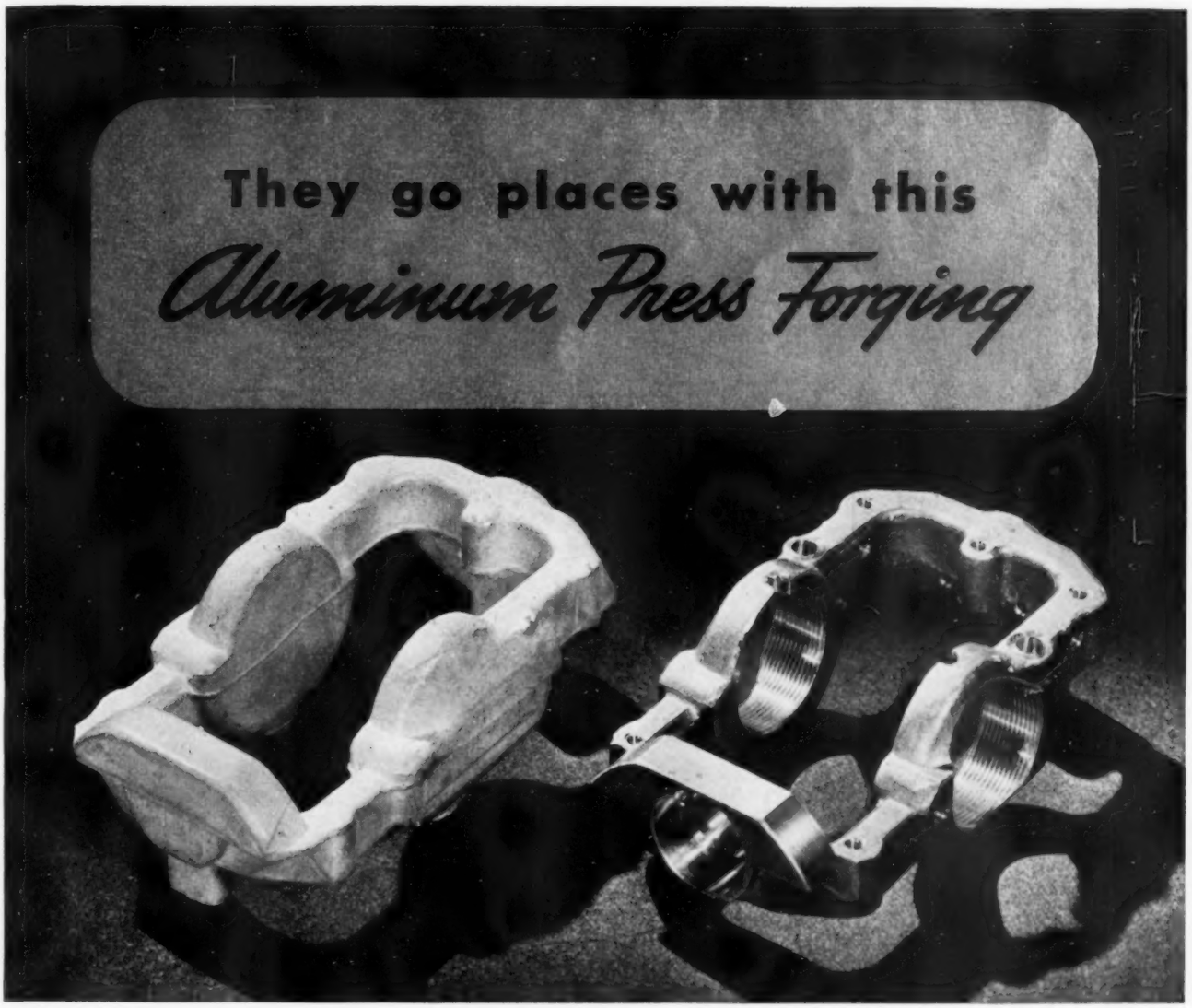
Welding Aluminum Alloy parts gives a high rate of production, lower fabricating costs and, often, improved products. Welding is done by torch, electric arc and the resistance welding methods; spot, seam and butt welding.

In the hands of the experienced Aluminum welder, the process is simple and rapid. Though the metal has distinct characteristics, the technique is easy to acquire. Welds meet all requirements for strength and accuracy. The resulting joints are neat and, if necessary, weld lines can be satisfactorily hidden.

Manufacturers of welding apparatus have developed equipment for use in resistance welding which provides accurately controlled timing, current and pressure. Specific instructions for *all* methods of welding Aluminum are given in the book, "Welding Aluminum." For a free copy, write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh, Pennsylvania.

IT IS THRIFTY TO USE ALCOA ALUMINUM WISELY

ALCOA ALUMINUM



Gimbal ring for the Sperry Directional Gyro and the directional unit of the Gyropilot

The low inertia and perfect balance of this "cradle" help make the gyroscope sensitive to every twist and turn of the ship. The light weight, rigidity, high strength and sound, uniform metal required here are provided by an Aluminum Alloy press forging.

The craftsmen who produce Alcoa Aluminum press and hammer forgings have devoted years of study to perfecting this science. Dies are constructed so that metal is made to flow just right as it takes shape. Maximum strength is developed in the direction of maximum stress. Forgings meet exacting specifications.

Parts can be quite complicated, eliminating many finishing and assembly operations. They are held to close tolerances, frequently permitting their use without the expense of machining. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh, Pennsylvania.

IT IS NEVER COSTLY TO USE ALCOA ALUMINUM RIGHT

ALCOA ALUMINUM

Grind to Closer Limits!

Step up your grinder output and improve finish with the De Laval Coolant Clarification System

The advantages gained through the installation of the De Laval Coolant Clarification System definitely help to lower your costs per unit of grinder production. Centrifugal force continuously removes harmful steel particles and abrasive grains from the coolant . . . resulting in the securing of better working surfaces in shorter time, grinding to closer limits and prolonging wheel life.

Handles all types of coolants

The De Laval "Hermetic" Coolant Clarifier handles all types of coolants, whether oil or aqueous—is simple to install and operate. The money it saves in increased output, improved product and lower maintenance expense quickly pays its cost. Write today for illustrated literature.

THE DE LAVAL SEPARATOR COMPANY

165 Broadway, New York **427 Randolph St., Chicago**

DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

Typical Advantages of the De Laval Coolant Clarification System

1. ***Improves Quality of Product***
   —by enabling the production of work having a uniformly better finish; lessens likelihood of distortion of work and starting of fatigue cracks.
2. ***Increases Production***
   —by permitting grinding to closer limits and maintaining fast cutting action of wheels over longer periods.
3. ***Reduces Costs***
   —by prolonging wheel life; minimizing wheel dressing; greatly increasing useful life of coolant, and minimizing cleaning of tanks and piping.

DE LAVAL COOLANT CLARIFIERS

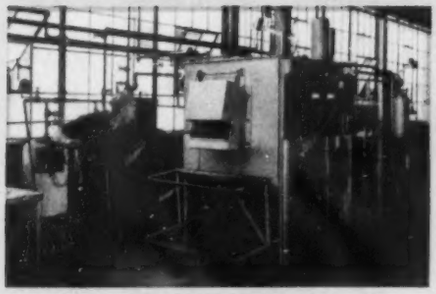
for GREATER GRINDING EFFICIENCY

GREATER PRODUCTION—plant expansion—emergency orders. A veritable RUSH HOUR for American Industry!

Is your heat-treating department, that most vital link in the whole chain of production, prepared to handle this extra business expediently and profitably?

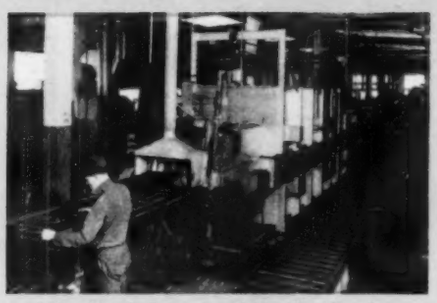
Electric furnaces and other electric heat-treating equipment will give you added capacity quickly and will enable you to make substantial savings. Turn the page to see 18 representative G-E equipments. They cover practically every requirement. They are standard, proved designs—not untried or experimental models. They are boosting production and saving time and money in installations throughout the world.

GENERAL ELECTRIC



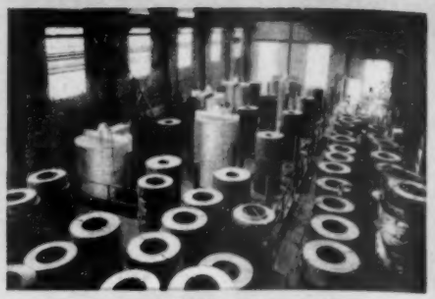
Box Furnace with Cooling Chamber and Protective Atmosphere

For brazing, sintering, bright annealing, and clean hardening without decarb. Temperatures up to 2750 F. Makes big savings in fabrication—eliminates costly scale-removing operations.



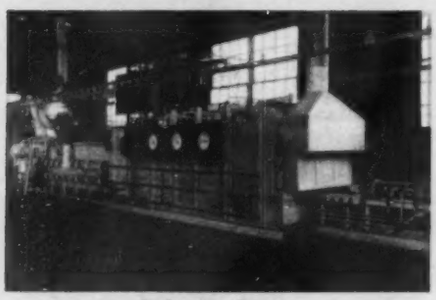
Roller-hearth Furnace with Cooling Chamber

For large-production brazing, annealing, and sintering. Temperatures up to 2050 F. Uses protective atmosphere—parts come out bright and clean. Makes substantial savings on labor, rejects, and maintenance.



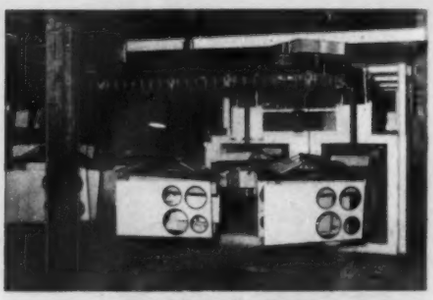
Bell Furnaces

For bright-annealing steel strip, wire, copper and other nonferrous wire and parts. Give quality production of high-grade, bright materials. Use protective atmosphere. Fan shortens time for heating and cooling—assures uniform temperature distribution.



Pusher-tray Furnace

For continuous annealing of small parts, forgings, stampings, and castings in a protective atmosphere. Practically eliminates rejects. No post-annealing scale removal necessary. Makes big savings—often pays for itself in a year's time.



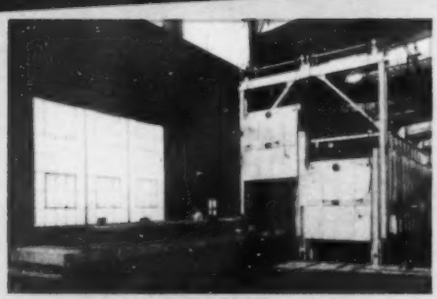
Porcelain Enameling Furnace

Outstanding for continuity of operation. Some have operated six years without a shutdown. Gives uniform high-quality firing, with fewer resprays or rejections. Saves on floor space, and maintenance. Standard box types also available.

Air-draw Furnace

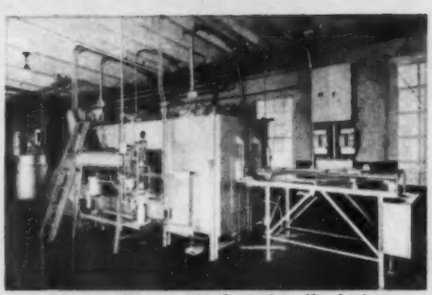
For tempering or drawing—after hardening—steel parts of all types. Temperatures up to 1400 F. Heating by forced convection circulates large volume of air through the charge—heats quickly and uniformly. Easily charged and unloaded.

18 Heat-treating Equipments to Boost



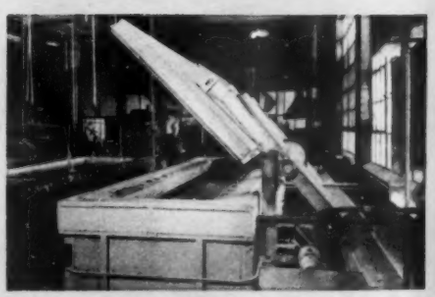
Car Furnace

For annealing and drawing alloy-steel bar stock and tubes, annealing iron and steel castings, and strain-relief annealing of large welded structures. This big furnace has the same characteristics as all electric furnaces—accurate control and uniform temperature distribution. Result—high-quality anneals are made on shorter cycles at lower costs.



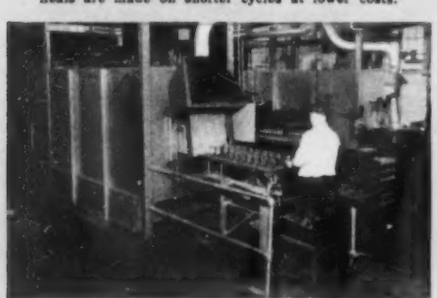
Conveyor Furnace for Scale-free Hardening without Decarburization

Outputs ranging from 50 to 1200 lb of parts per hour are hardened without decarb or formation of scale. Equipment for producing protective atmosphere included. Automatic control. Parts after being placed on conveyor require no attention until discharged automatically from quenching tank.



Salt-bath Furnace

For heat-treating aluminum-alloy sheets and parts. For drawing steel parts. Temperatures up to 1000 F. Can be controlled accurately and automatically within narrow limits for uniform, high-quality work. Heats rapidly and uniformly because units are immersed directly in salt.



Mesh-belt Furnace with Cooling Chamber

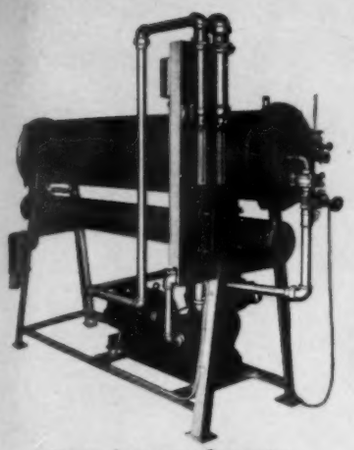
For continuous production of furnace-brazed, bright-annealed, or sintered parts. Uses protective atmosphere. Provided with variable-speed drive. Work is loaded directly on belt and emerges bright and clean.

Pit Furnaces

For annealing, hardening, and drawing of gun forgings. Also for shrinking. Gives accurate control—uniform temperature distribution. Improves quality, reduces rejects, increases output. Rectangular types are available for annealing bar stock and tubes.

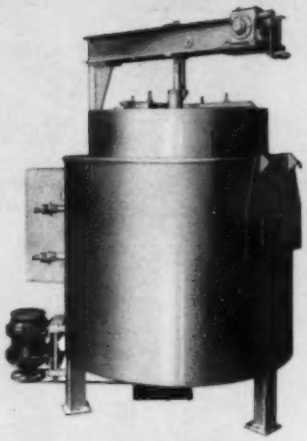
Rotary-hearth Furnace

For hardening and drawing forged or machined parts. Can be equipped with protective atmosphere. Charging and discharging doors near each other for convenient loading and unloading. Every part receives uniform time-temperature treatment.



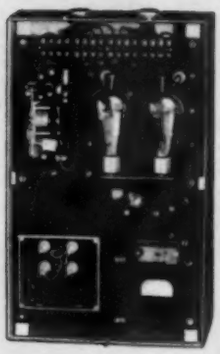
Atmosphere-gas Converter

Produces inexpensive protective atmosphere gas by processing available city gas, natural gas, butane, or propane. Gives constant-analysis gas for uniformly bright work. Available in sizes from 200 to 25,000 cfh. Other equipment also available for removing sulfur, moisture, and carbon dioxide from protective gases.



Gas-carburizing Furnace

Here's a NEW furnace that can save from 50 to 80 per cent on operating costs, reduce the length of the carburizing cycle, and practically eliminate rejects. Uses no packing material. A carbon-rich gas provides a controllable, uniform source of carbon. Carburizing is uniform on all surfaces in every part of the furnace.



Reactrol System

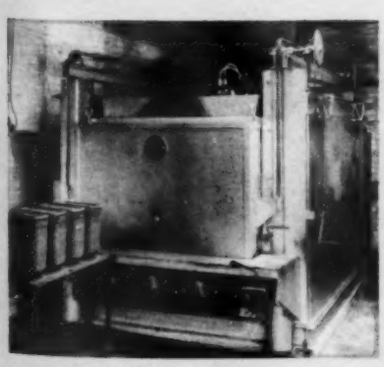
The Reactrol system is used for extremely accurate temperature control of electrically-heated processes, ovens, boilers, and similar devices. Provides automatic, practically instantaneous throttling action of the electric power. This results in extremely accurate temperature control and minimum temperature gradient between heating units and work. Single unit controls inputs up to 450 kw.

st Production and Save Time and Money

These equipments have proved their ability to cut costs, save time, and boost production. Each type is built in a wide variety of sizes.

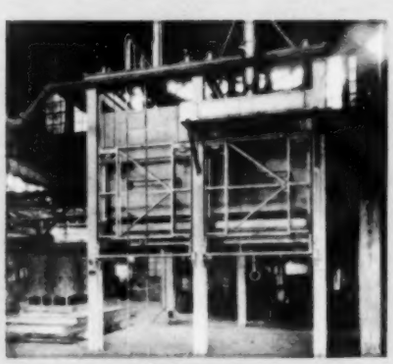
Here's a typical example of the savings possible. A midwestern manufacturer replaced old-type, fuel-fired equipment with G-E electric furnaces. He cut his annealing time for malleable castings from 7 days to 1, saved $11 a ton on annealing costs, and improved the quality and uniformity of finished parts.

The heating specialist in your local office can show you how to apply electric heat to achieve similar savings.



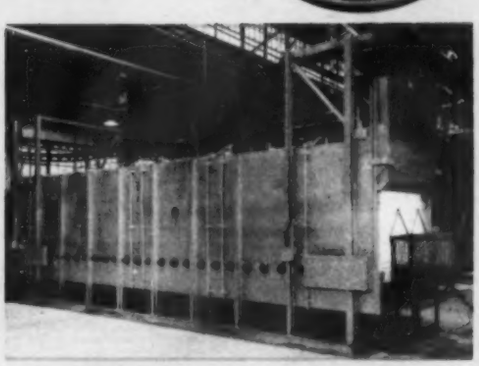
Box Furnace

For miscellaneous heat-treating jobs such as normalizing, tempering, pack-carburizing, hardening, and annealing. Ideal for applications requiring a variety of treatments or where output does not warrant continuous production.



Elevator Furnace

For annealing malleable castings, tubing, cast iron, etc. Can be used with protective atmosphere. Makes big savings in time and money. Practically eliminates rejects. Two-chamber type shown. Available as single-chamber type. Savings have returned cost of furnace in a year.



Roller-Hearth Furnace for Annealing Brass

For large-production annealing of brass parts after drawing. Furnace shown is equipped with water-spray quenching chamber and automatic discharge equipment.

Midget Heating Units Save Time and Money, Too

Here are representative samples of some widely adaptable, easily installed, small heating units. All are stock items that can be shipped immediately and put to work quickly. You can use them for dozens of small heating jobs, or for building your own equipment to handle larger jobs.

Strip Heaters

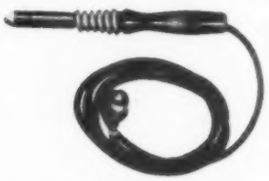
Can be used for air heaters (as in ovens) or as clamp-on units for metal surfaces. For temperatures up to 1200 F. Ratings 150 to 1500 watts in lengths from 7 to 35½ inches. Send for bulletin GEA-1157.

Immersion Units

Direct immersion provides rapid and efficient heating of oil, water, plating solutions, and other liquids. Sizes and shapes to meet every application. Easy to install and control. Send for bulletin GEA-214.

Forced-convection Unit Heater

Provides an instant blast of clean, warm air at snap of switch. Use it for a fan in summer. Particularly useful for heating out-of-the-way locations hard to reach with steam heat. Sizes from 2 to 15 kw. Send for bulletin GEA-2592.



Heavy-duty Soldering Irons

Built for continuous operation. Fast heating. Cool handle. Removable tips in sizes from ⅜ to 2 inches in diameter. Sizes, 75 to 350 watts, also 650 and 1250 watts. Send for bulletin GEA-2619.

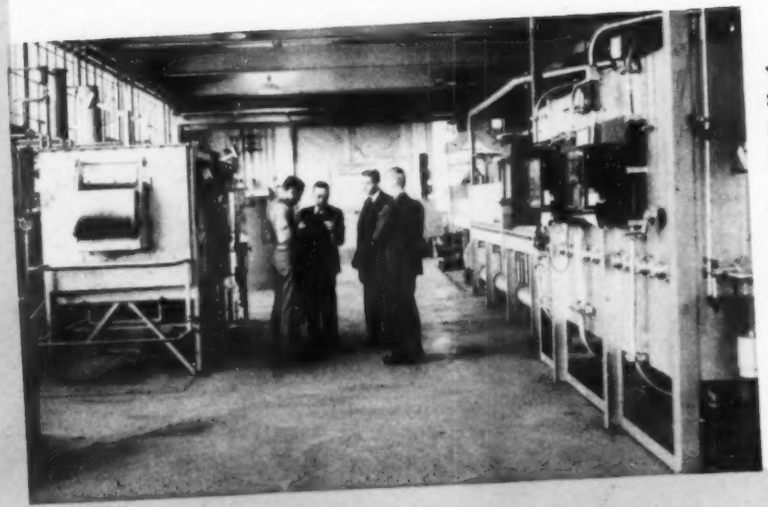
Metal-melting Pots

Heat lead, babbitt, tin, type metal, and similar metals and alloys, to temperatures not exceeding 950 F. Ten to 3000-lb capacity. Low radiation losses and quick heating attained by immersing heating units directly in metal. Send for bulletin GEA-164.

Oven Heaters

Built for continuous, economical operation. Ratings 1.8 to 5 kw, temperatures up to 1150 F. Heats ovens, kettles, melting pots, tanks, etc.

SEE and TRY before you BUY



You don't have to guess about the results you'll get when you buy G-E electric equipment for heat-treating metals. You can SEE and check the results in our Industrial Heating Laboratory.

We'll be glad to heat-treat samples of your product in the commercial types of furnaces operated by the Laboratory. Thus, you will know exactly what kind of results you can get with various types of electric equipment.

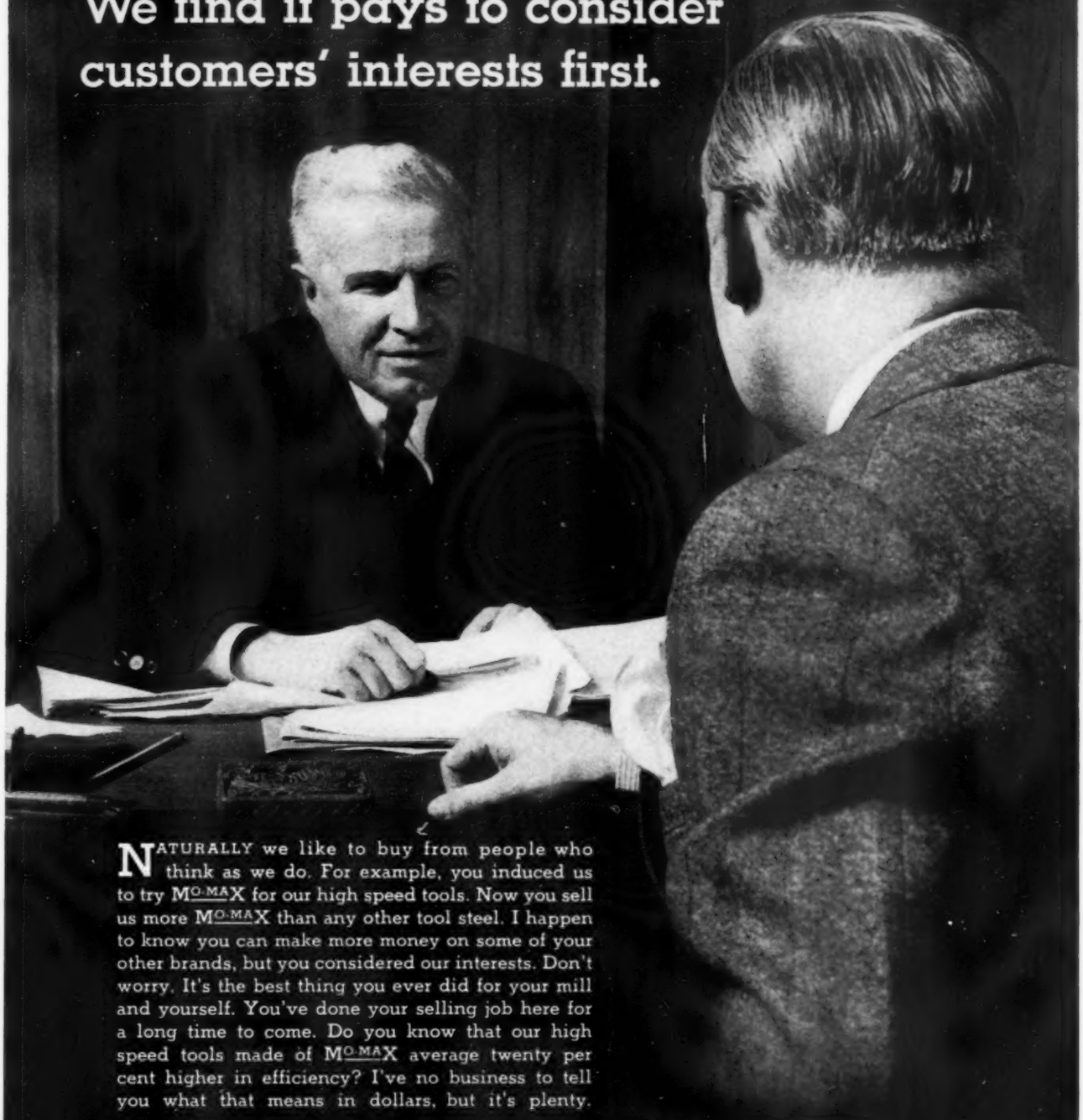
Many companies are taking advantage of this valuable, low-cost service. Why don't you? The heating specialist in our local office will handle all arrangements. Or write to General Electric Company, Schenectady, N.Y.

GENERAL ELECTRIC

675-13

SCHENECTADY, N. Y.

We find it pays to consider customers' interests first.



NATURALLY we like to buy from people who think as we do. For example, you induced us to try MO-MAX for our high speed tools. Now you sell us more MO-MAX than any other tool steel. I happen to know you can make more money on some of your other brands, but you considered our interests. Don't worry. It's the best thing you ever did for your mill and yourself. You've done your selling job here for a long time to come. Do you know that our high speed tools made of MO-MAX average twenty per cent higher in efficiency? I've no business to tell you what that means in dollars, but it's plenty.

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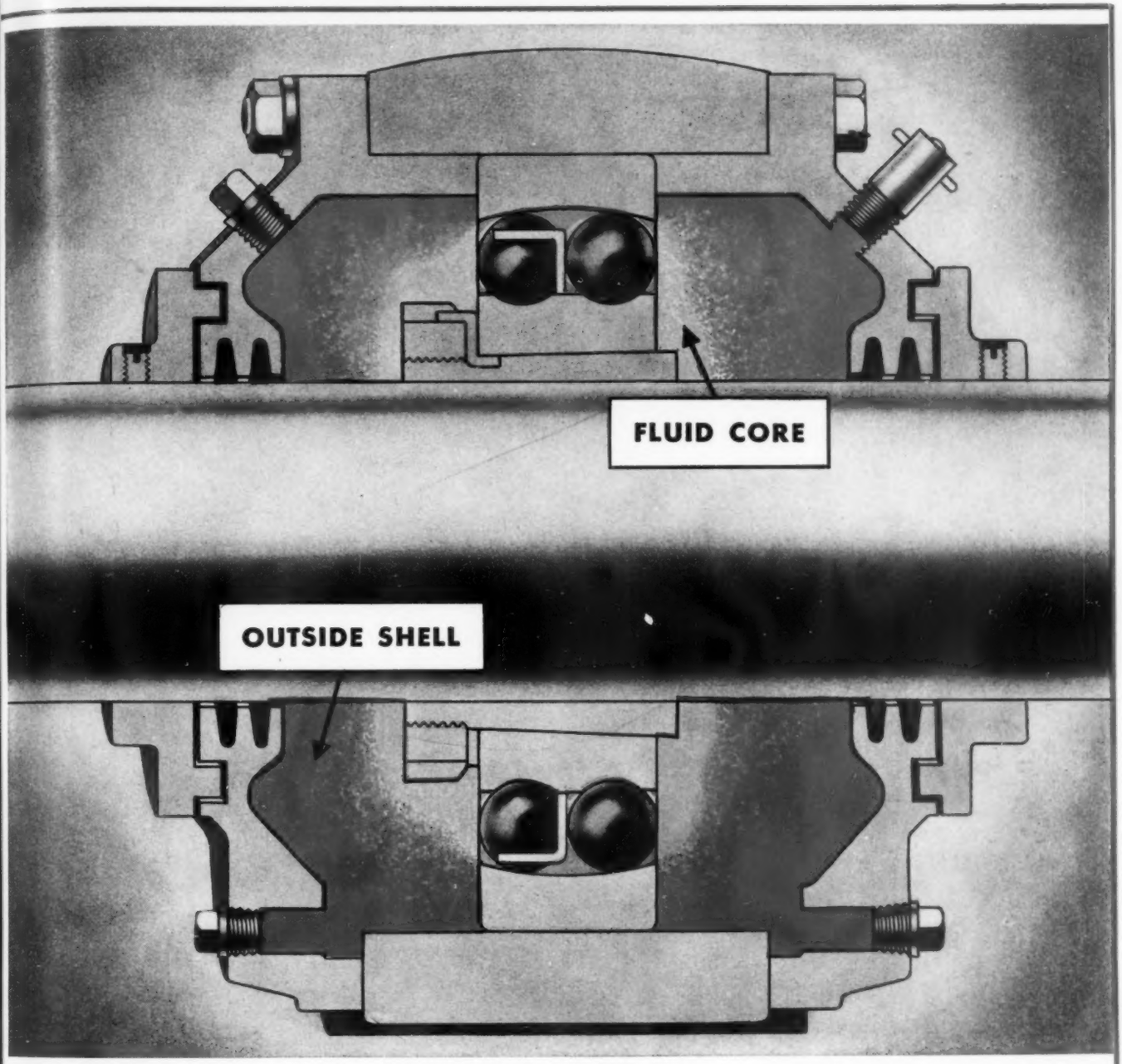
You'll Profit from these "Exclusives"

SKILLED LUBRICATION COUNSEL of a Socony-Vacuum man backed by 74 years' experience . . . the greatest in the Petroleum Industry.

A COMPLETE LINE of Lubricants . . . the scientifically correct lubricant for every type of machine you now own . . . or will buy.



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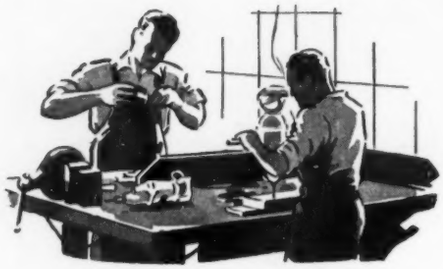
"FACTORY SERVICE" *All over the Map*

Cuts Down "Time Out" for Tool Repairs



Factory Trained Mechanics give prompt, efficient service to Black & Decker Tool owners from coast-to-coast. You can have factory service, no matter where your plant is located.

With industry in high-gear, fast servicing of electric tools is an absolute necessity. Black & Decker Tools don't have to be sent "back to the factory" for overhaul—with consequent delays and tie-ups. There are 25 Black & Decker Factory Branches in strategic United States and Canadian cities—set-up to deliver "factory service." Each Branch is manned by factory-trained mechanics, equipped with complete servicing and repair facilities, including genuine B & D replacement parts. The *only* such facilities in the portable electric tool industry.

By making Black & Decker Quality Tools your choice, you first minimize repairs. Secondly, if you should need service, you eliminate delays. Consider these facts—then ask your distributor to demonstrate the portable electric tools you need—or write: The Black & Decker Mfg. Co., 716 Pennsylvania Ave., Towson, Md.

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Black & Decker

BLACK & DECKER MFG. CO. ELECTRIC TOOLS TOWSON, MD.

PORTABLE ELECTRIC TOOLS

99.8% ACCURACY

- **ACCURACY**—The grand average accuracy of the last 100 Southwark-Tate-Emery testing machines installed in the field, involving 227 ranges, is 99.8% of true load over the entire range — from zero to maximum.*
- **SENSITIVITY**—The Tate-Emery null method load indicator will read down to ¼ lb on a 100,000-lb capacity universal testing machine—and maintain the above accuracy. Any Southwark-Tate-Emery testing machine has this potential sensitivity when equipped with suitable low range dial.
- **EXCLUSIVE FEATURES** — Range change during test • Positive control of loading • Automatic load maintenance • Absolute zero restoration • Servo-motor load balance • **NEW** — Three range null point dial • Backlash eliminators • Illuminated dial • Dual crosshead control

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Our Engineering Staff will be pleased to aid in selecting the right bearing for any type of job. Perhaps we can offer suggestions which will save you time, labor and money. Send for latest catalog and complete information.

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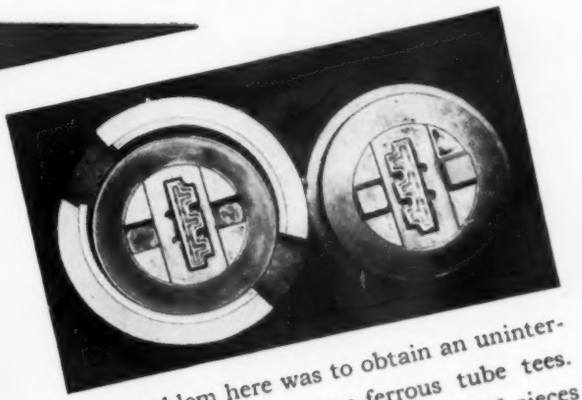
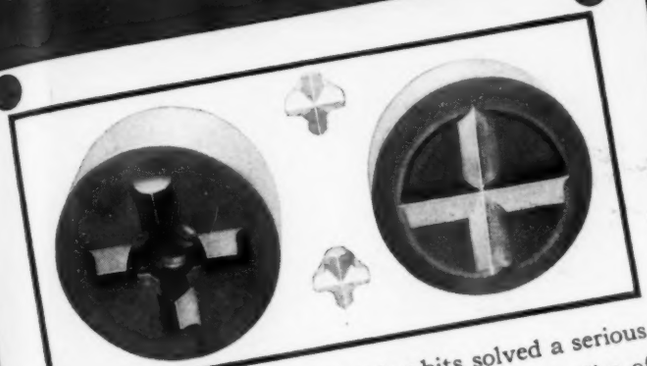
All Hot working Operations

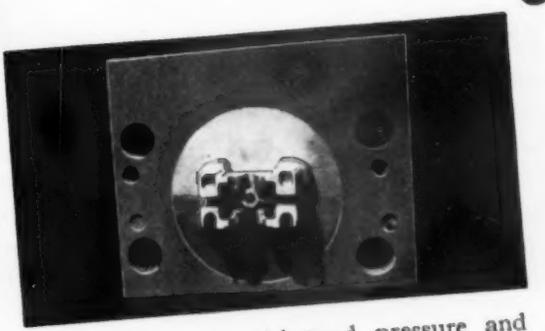
. . . but each requiring a die steel of *different characteristics*



The problem here was to obtain an uninterrupted run forging non-ferrous tube tees. Dies of Atlas B had produced 255,266 pieces when this photograph was taken.

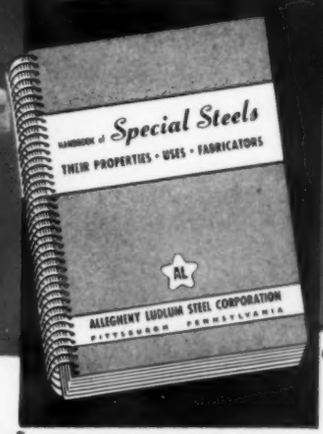


A manufacturer of rock drilling bits solved a serious hot forging die problem by the use of insert dies of Mohawk Hot Die. These dies previously weighed 100 pounds. Now the insert dies and punch blanks weigh 13 and 15 pounds respectively. Die life has been greatly increased.



Dies that would withstand pressure and produce long runs was the basic consideration in the selection of the tool steel here. Dies of Seminole produced 150,000 parts at a pressure of 60,000 pounds per square inch.

Selecting the RIGHT steel for each operation is reduced to a science when you have this 160 page book ➡



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Tool Steel Division: Watervliet, N. Y.

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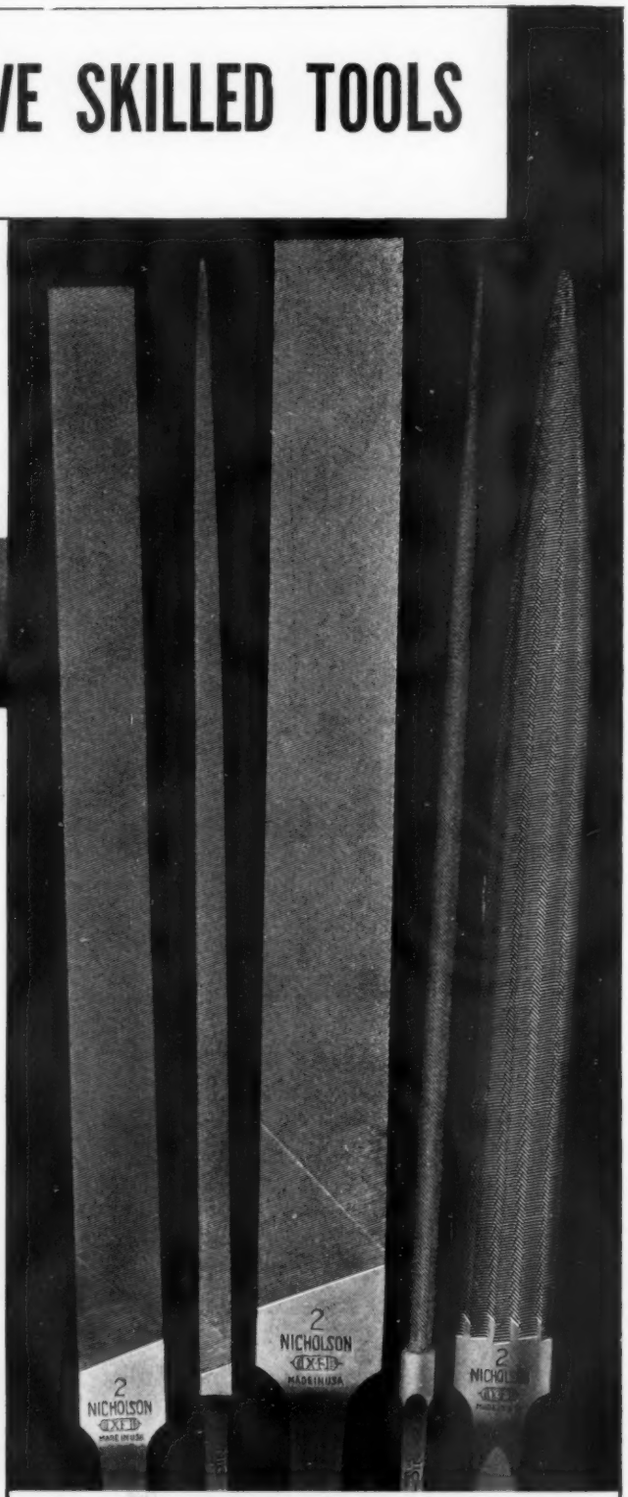

• *Five popular shapes (actual size) of Nicholson Die-sinker files in Swiss Pattern designs and cuts.*

DIE-SINKERS, model makers, delicate-instrument parts finishers can do their best work only when their supplies of small files are *right for the job*—in shapes, sizes, cuts and *quality*.

Therefore, it is only logical that where speed and efficiency are the watchwords, industrial managements should turn to the world's largest file maker when stocking these important tools. For *precision files require the precision manufacture which only long experience and ample facilities can assure.*

Nicholson X. F. Swiss Pattern files are made to highly exacting standards. Points are smaller, tapers are longer and cuts are finer than in the conventional "American Pattern" files for similar purposes. Cleaning out, burring, enlarging small holes, shaping and finishing extra-narrow grooves, slots, notches and keyways are more readily and accurately accomplished.

The automotive, aircraft, die-making and industrial-arts industries use Nicholson X. F. Swiss Pattern files extensively. Assortments are wide, designs are correct, satisfactory performance is assured under Nicholson's guarantee of *Twelve perfect files in every dozen.*

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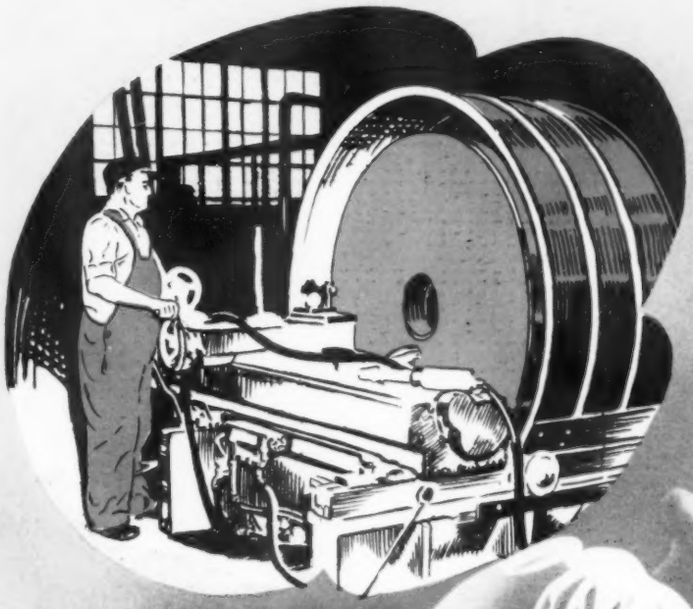
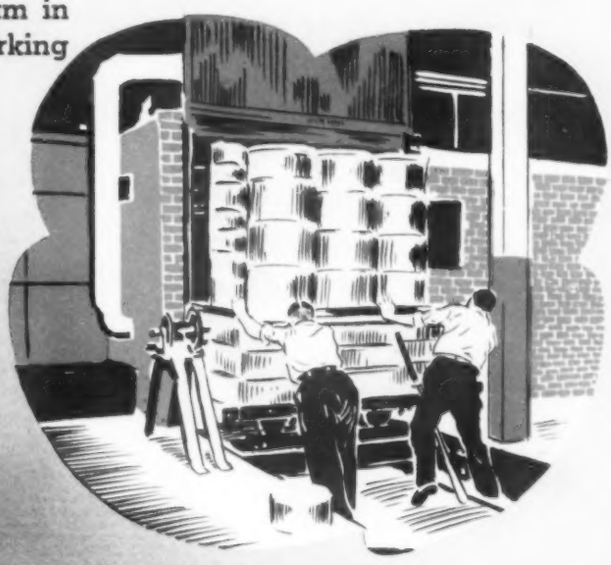
Better Grinding Wheel Production Facilities —Better NORTON SERVICE

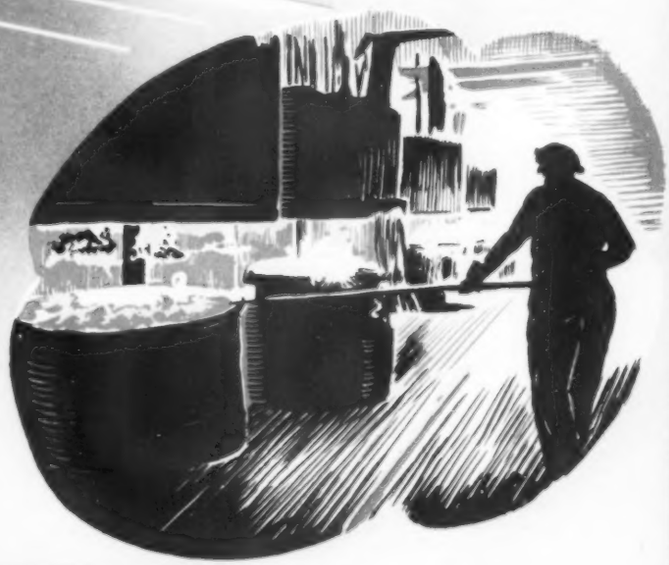
The extensive Norton plant modernization program in the interest of Norton Service to the metal working industries is now nearing completion.





New plant buildings permit greatly improved facilities:

- —new tunnel kilns for increased burning capacity
- —more and better equipment for such operations as truing, bushing, balancing, testing and grading
- —an extensive conveyor system for easy handling without loss of time



A new department for organic process wheels (resinoid, rubber and shellac bonded) is equipped with the most modern press and oven equipment.

Alundum and Crystolon abrasives are being produced at the Norton electric furnace plant in both variety and quantity greater than ever before.

NORTON ABRASIVES

HANDLING HEAT
for the Metal Working Industries

NORTON SERVICE

Melting Metal . . .

Resistance to high temperatures, chemical resistance toward oxides and low permeability toward molten metals — these are the features of Norton Cements and Bonded Shapes (Alundum, Crystolon and fused magnesia) that are reducing lining costs in many types of furnaces for melting ferrous and non-ferrous metals.

Norton Cements and Bonded Shapes for Melting Metal

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Because they have high electrical resistance even at elevated temperatures, high refractoriness, high heat conductivity, high permeability and low coefficient of expansion, Alundum Tubes are showing outstanding performance in high temperature, wire wound electric resistance furnaces of all kinds — especially in the drawing and swaging of tungsten and molybdenum wire and sintering cemented carbides for tools.

Alundum Tubes for Sintering Metal

Hardening Metal . . .

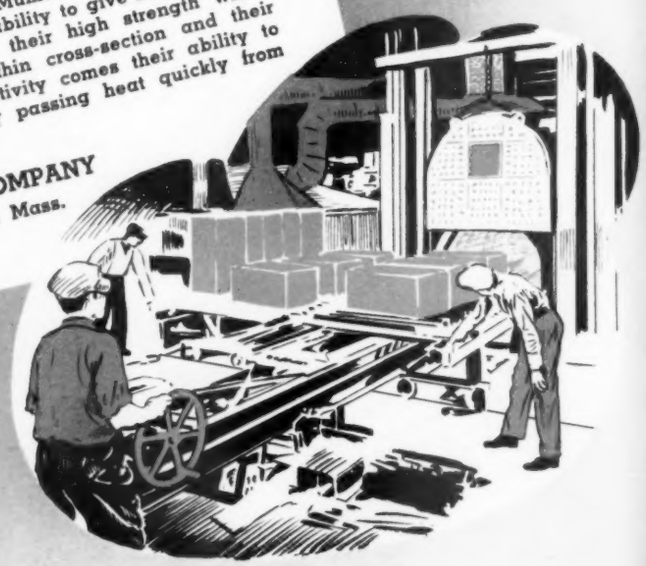
High refractoriness, great strength, high heat transfer, resistance to spalling and resistance to abrasion — these five features of Crystolon Hearth Plates and Crystolon Muffles are assuring long lining life and low fuel costs in heat treating furnaces of many types.

Enameling Metal . . .

From the high refractoriness and chemical stability of Alundum Muffles for enameling furnaces comes their ability to give long, trouble-free service. From their high strength which allows plates of thin cross-section and their high heat conductivity comes their ability to cut fuel costs by passing heat quickly from source to work.

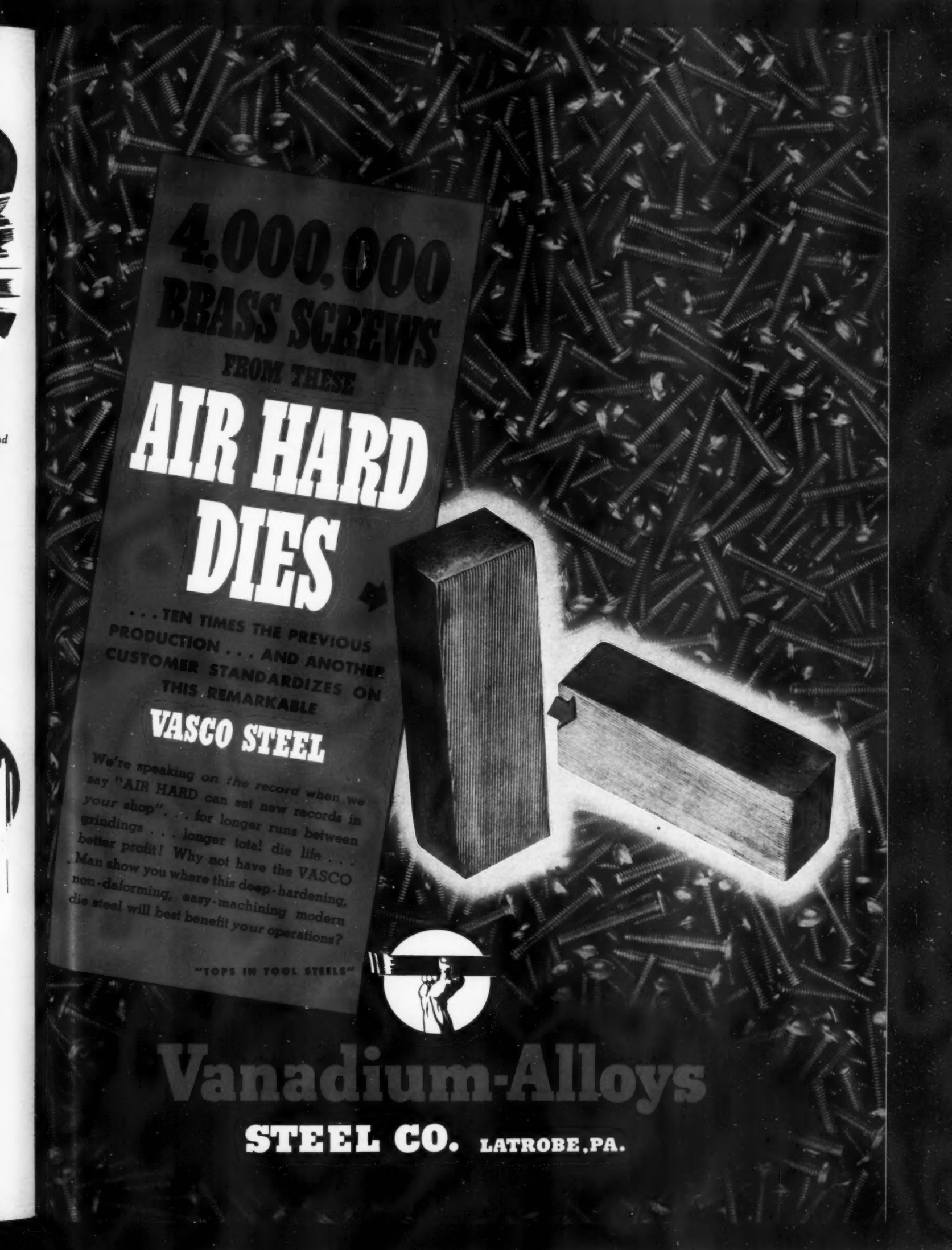
NORTON COMPANY
Worcester, Mass.

Crystolon Hearth Plates for Hardening Metal



Alundum Muffles for Enameling Metal

NORTON REFRACTORIES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in many cases approaching the cost of High Speed Steel Tools,
make possible far wider use of
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COMPLETE PRICE INFORMATION WILL ALSO BE AVAILABLE AT OUR BOOTH AT THE NATIONAL METAL SHOW, CLEVELAND, OCT. 21 to 25.

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Ready for metal working and heat treating problems which are bound to rise as industry swings into action to meet the urgent need for national defense.

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That cumulative experience has led to our present processing products — modern . . . geared to today's production needs... aimed at the one objective of quality performance at lower cost per unit produced.

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at the NATIONAL METAL EXPOSITION
CLEVELAND PUBLIC AUDITORIUM
Oct. 21-25

The No. 10 Planograph, one of an extensive line of gas cutting machines being widely used in America's National Defense program, will be the feature of Airco's display of the Metal Show. Already gaining wide acclaim because of its outstanding performance, this Planograph cuts straight lines, rectangles, circles, irregular shapes, etc. quickly and economically from ferrous metal of any thickness within the present practical limits of the cutting torch. A minimum of floor space is needed as the illustration to the right shows so well.

This is your opportunity to see the No. 10 Planograph in action . . . at Booth G-20, the Metal Show.

The Nos. 4 and 10 Radiagraphs will be demonstrated—also on display will be the latest attachments on these machines, the most recently developed apparatus for plate edge preparation, for manual grooving, for welding, cutting and brazing.

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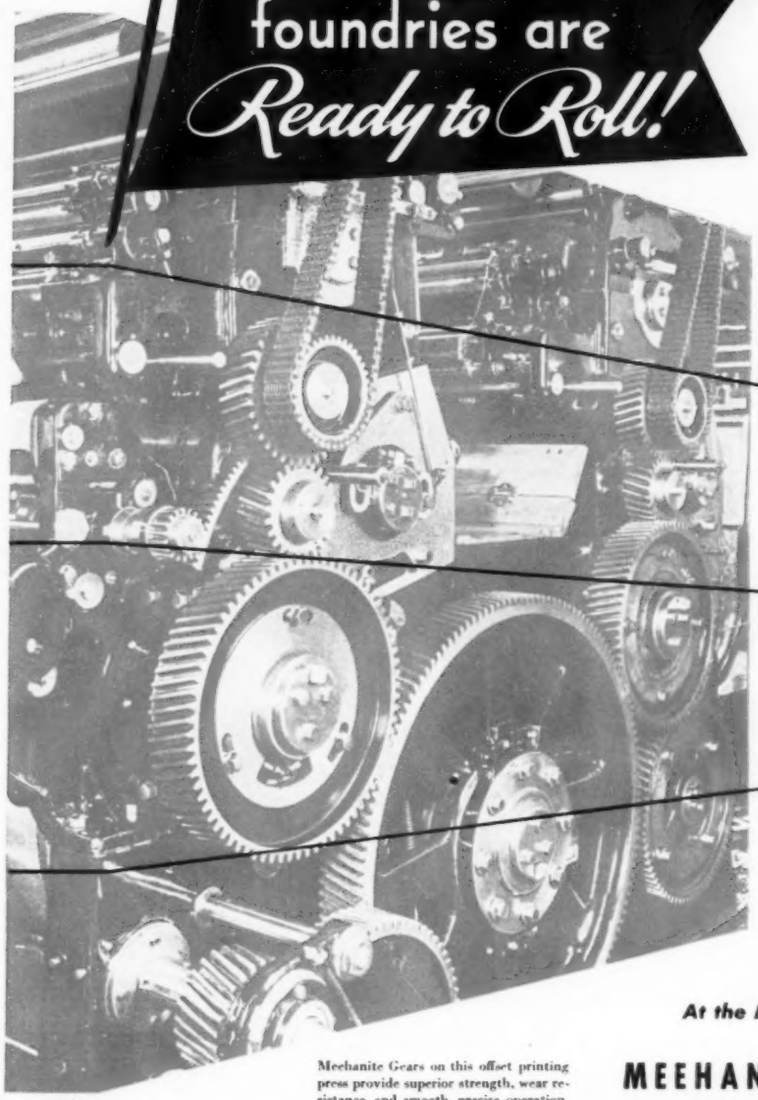
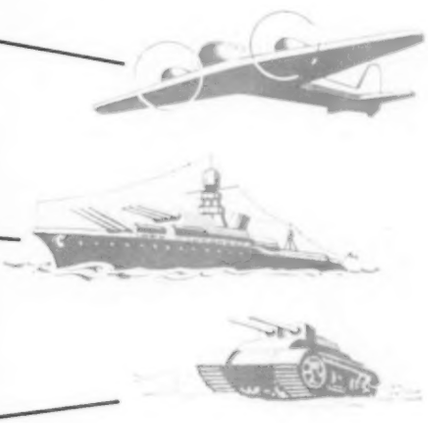
MEEHANITE foundries are *Ready to Roll!*



Meehanite Gears on this offset printing press provide superior strength, wear resistance, and smooth, precise operation.

Like the printing press shown in the picture every Meehanite foundry in the United States is "Ready to Roll"—ready to provide you quickly with *better* castings for your regular or new jobs.

If you are faced with new tasks involving armament or other products needed in the national defense program Meehanite can prove especially helpful to you. Meehanite is an *International* product with foundries all over the world. There are seventeen in Great Britain, for instance, all of which already have had *several years experience* in armament and defense work. *All* the experience, data, service and test records



accumulated *there* have been made available and placed in the hands of Meehanite foundries *here*. *You* can profit from it. Take your casting problems to a Meehanite foundry.

At the Metal Show in Cleveland Visit Booth G-5

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Cincinnati, Ohio	Cincinnati Grinders Incorporated
Cincinnati, Ohio	The Cincinnati Milling Machine Co.
Cleveland, Ohio	Fulton Foundry & Machine Co.
Denver, Colo.	The Stearns-Roger Mfg. Co.
Detroit, Mich.	Atlas Foundry Co.
Flint, Mich.	General Foundry & Mfg. Company
Hamilton, Ohio	Hamilton Foundry & Machine Co.
Irvington, N. J.	Barnett Foundry & Machine Co.
Los Angeles, Calif.	Kinney Iron Works
Milwaukee, Wis.	Koehring Company
Mt. Vernon, Ohio, Grove City, Pa.	Cooper-Bessemer Corporation
New York, N. Y.	The American Brake Shoe & Foundry Co.
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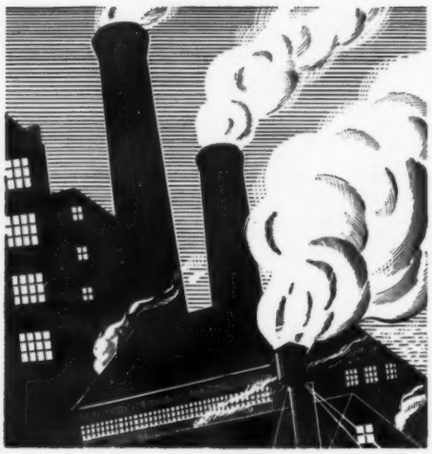
Waterloo, N. S. W.	Australian Meehanite Metal Co., Ltd.

What is America's Secret Weapon of Defense?



It isn't secret at all—this great weapon of America that forms such an essential and dependable bulwark in the scheme of national defense. Most of us come in contact with some part of it during every business day. Countless thousands of us *are* part of it. For this great "Secret" Weapon of Defense is American Industry!

The same American Industry that showed the way to the world in producing the first practical machine gun, the first submarine, the first airplane.

The same American Industry that in an earlier day established the supremacy of the rifled firearm, gave the world its first steamship, demonstrated the defensive value of armored vessels of war.

The same American Industry that is organized today as never before in its history . . . that in this era of mechanized warfare has become America's first line of defense . . . that is "secret" because no one in all the world has ever been able to gauge the full extent of its productive capacity!

SKF, with its vastly increased facilities for producing ball and roller bearings that are now being used by the Army and Navy and Air Corps, is proud to take its place alongside of the thousands of other industrial organizations that form: America's "Secret" Weapon of Defense. SKF Industries, Inc., Philadelphia, Pa.

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Engineering and Metallurgy *combine* with Experience and Skill to *produce* WYCKOFF *Cold Drawn Steels*

Every WYCKOFF process is a deliberate, strictly regulated refinement of controlled-manufacture steel, to mold its character and shape to your exact requirements.

Grain size, analysis, physicals, size and section accuracy, restricted tolerances, straightness—all of these factors of steel's usefulness are every-day requirements readily met by skilled workmanship and experienced engineering at WYCKOFF. Capable metallurgy, too, keeps close watch on every bar, every grade, every operation and modern, complete furnace facilities for annealing, stress-relieving, quenching and tempering meet every demand. Combined, they produce WYCKOFF Cold Drawn Steels of unexcelled quality, uniformity and exact fitness for your job. For *your* cold finished steel requirements, it will pay you to specify WYCKOFF.

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Cooling plates, ground and polished on upper surface made of Meehanite by American Brake Shoe and Foundry Co.

You can rely on castings of ABSCO Meehanite in quantity lots for the uniformity needed to meet today's exacting production schedules and contract requirements.

SELECTIVE PROCESSING provides ABSCO Meehanite with the combination of these qualities that fits your needs.

1. *Combined strength and toughness*
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Our Laboratory ... HELPS YOU SOLVE YOUR SOLDERING PROBLEMS

In this age of alloys, soldering is a science . . . a science contributed to by the Kester Solder Company and made available to solder users in all industrial fields.

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100 different solder alloys
10 different solder fluxes
80 different solder strand sizes
4 different solder core sizes

You can see at a glance that the number of possible combinations is almost endless. Kester engineers will aid in the selection of the right alloy, the right flux, the right strand and core size to do your work with the greatest possible speed and economy.

You may be sure that soldering problems in your business will come within the scope of Kester's experience or ability to solve. Kester plants are the largest and best equipped in the entire industry, and 43 years of specialization in solder manufacture have produced the one quality line that meets every soldering requirement.

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STANDARD FOR INDUSTRY

BREAK UP THAT BOTTLE NECK!

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DELTA MACHINE TOOLS INCREASE PRODUCTION

When there is an urgent need for quick expansion, reduced costs, increased production—thousands of manufacturers have found Delta low cost machine tools the answer! These amazingly efficient power tools—drill presses, cut-off machines, grinders, sanders, band saws—are flexible and versatile enough to fit your special requirements. They can be used for straight line production in any number of combinations, as auxiliary tools to augment your present equipment—for special set-ups to eliminate costly special purpose machines. They are portable and compact and can be switched around quickly to fill changing needs. Best of all—you can get immediate delivery RIGHT NOW!

Delta drill presses especially adapted to meet the needs of the Eclipse Aviation Division of the Bendix Corporation—with more than 100 in use throughout the plant.

DELTA

.S • INDUSTRIAL MACHINE TOOLS • INDUSTRIAL MACHINE TOOLS • INDUSTRIAL MACH

DELTA MACHINES cut c

-they can Reduce Your Costs -

The installations shown here are only a few of the hundreds of Delta installations in plants of all types, from the finest in the country to the smallest machine shop. Delta pioneered the light machine tool, and years of experience backed by alert, progressive, engineering and advanced manufacturing methods enable Delta machines to "stand up and take it" in any production shop.

70% OF ALL PLANT EQUIPMENT OUT-OF-DATE!

SAYS RECENT SURVEY

HERE'S HOW YOU CAN AVOID OBSOLESENCE--INCREASE PRODUCTION CUT COSTS -- REDUCE INVESTMENT

Figures just published show that 70% of all American machine tools are over ten years old —practically out of date for modern production. YOUR plant equipment may be above the average, but it will pay you to investigate low cost Delta drill presses, metal cutting band saws, grinders, polishing machines and cut-off machines which will reduce your investment, reduce operating and maintenance costs, increase production and avoid obsolescence.

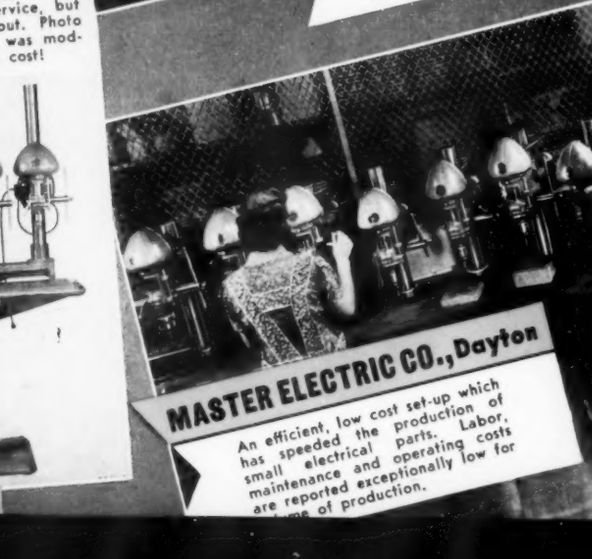
Your production problems are your own—to be solved in your own individual way. But take a tip from other progressive manufacturers—and investigate what Delta has to offer you—TODAY!

BINKS MFG. CO. Chicago, Ill.

Two 6-spindle units in this plant use the new Delta sectional table, which provides a table of any length and any number of heads—at minimum cost. Rolling seat for operator increases efficiency; speeds production.

BELL&HOWELL CO. Chicago.

One unit of 18 Delta drill-press heads for accurate drilling and tapping operations on finest of precision movie equipment. Both 14" and 17" drill heads are used in this set up, illustrating flexibility of Delta multi-spindle drills.



EVINRUDE MOTORS, Milw.

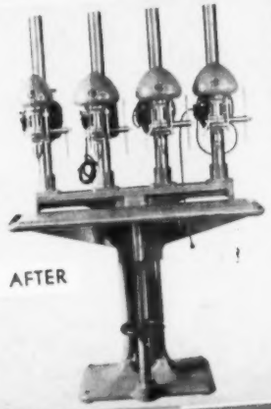
This four-spindle 17" drill is one of a large number of Delta drill presses used here, single, double and four spindle units are used to increase production throughout the entire shop.

HOW MANY "CRIPPLES" ARE THERE IN YOUR PLANT? YOU CAN MODERNIZE THEM AT LOW COST THIS SIMPLE EASY WAY!

BEFORE

Four Delta drill press heads, columns and flanges were mounted on the old base—no other changes. Result: a modern four-spindle drill at a cost of approximately $70.00 per spindle, [illegible] counterbalance and motor!

Base and table of drill press at left were good for years of service, but heads were completely worn out. Photo below shows how machine was modernized—at surprisingly low cost!



AFTER

MASTER ELECTRIC CO., Dayton

An efficient, low cost set-up which has speeded the production of small electrical parts. Labor, maintenance and operating costs are reported exceptionally low for [illegible] of production.

ut costs in these typical shops
sts - Increase Your Production

KEARNEY & TRECKER CORP., Milw.

This 16-spindle Delta set up speeds production of famous milling machines. In addition to drill presses, this plant uses Delta tool grinders and cut-off machines.

J. P. SEEBURG CO., Chicago, Ill.

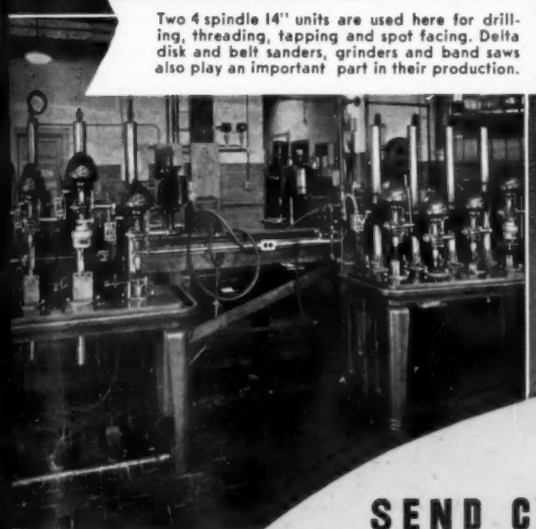
The flexibility and portability of Delta single-spindle drills is an important feature in this plant. Drills can be set up in any number and in any arrangement to suit changing production requirements.

BINGHAMTON DIE & MACHINE CO., Binghamton, N

Time is saved and costs are cut in this shop by placing a 14-inch dri press next to each tool maker' bench. Delta Grinders and meta cutting band saws conserve too makers' time.

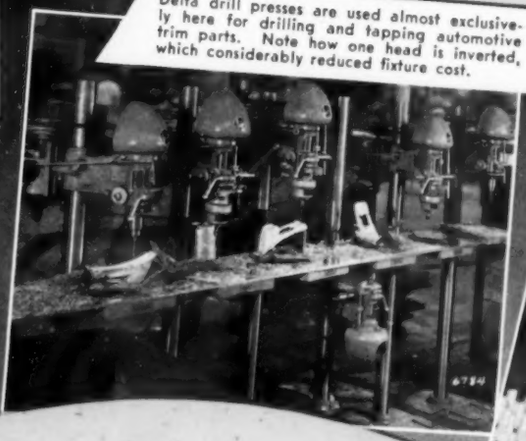
SCHULTZ DIE CASTING CO., Toledo

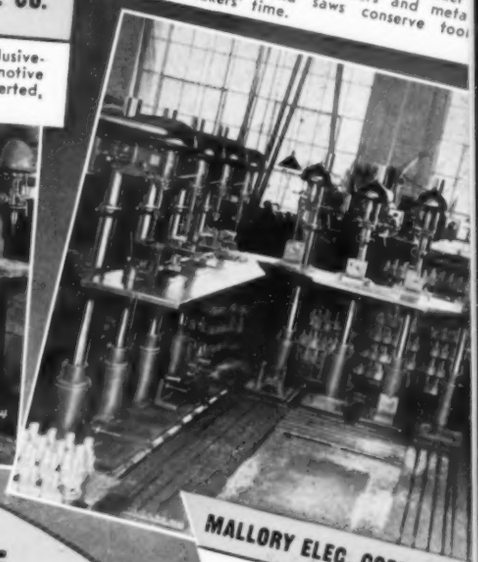
Two 4 spindle 14" units are used here for drilling, threading, tapping and spot facing. Delta disk and belt sanders, grinders and band saws also play an important part in their production.



ALEMITE DIE CASTING & MFG. CO. Woodstock, Ill.

Delta drill presses are used almost exclusively here for drilling and tapping automotive trim parts. Note how one head is inverted, which considerably reduced fixture cost.





MALLORY ELEC. CORP., Detr

An interesting production set-u of twelve 17-inch drill presses i a novel U-shaped layout, operatio begins at the left and passes to the right.

SEND COUPON ON NEXT PAGE
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INDUSTRIAL MACHINE TOOLS

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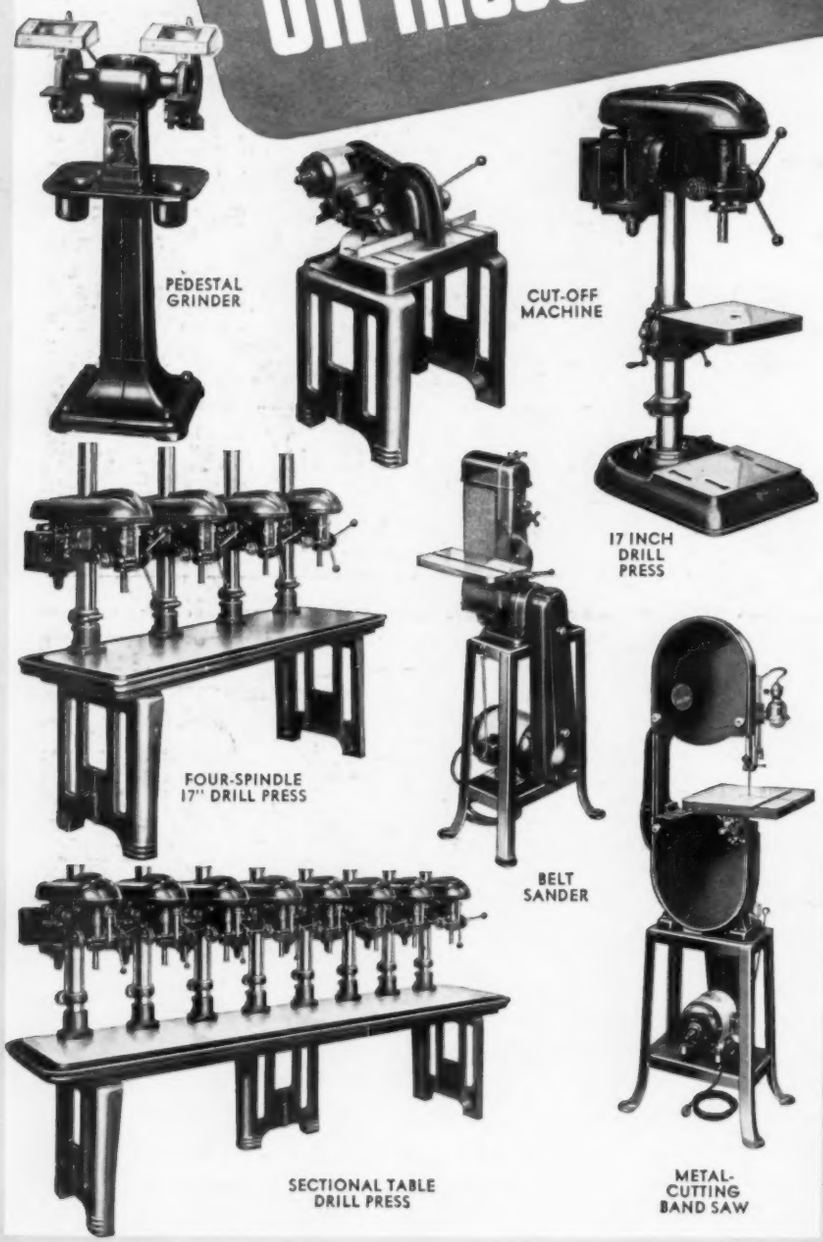

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Philadelphia WORM GEAR SPEED REDUCER
right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.
Philadelphia HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.
Philadelphia MOTOREDUCER
The economical self-contained drive. Horizontal or Vertical types—various ratios and horsepowers.
Philadelphia GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

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"HE'LL NOT ONLY FIND A GEAR HERE—BUT HE'LL ALSO GET A LOT OF ENGINEERING DATA."
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● One of the greatest helps to designers BEFORE they get into production, is complete and up-to-date information on gearing. That is why Phillie Gear puts such a wealth of material in this catalog. It is virtually a text book on gearing.

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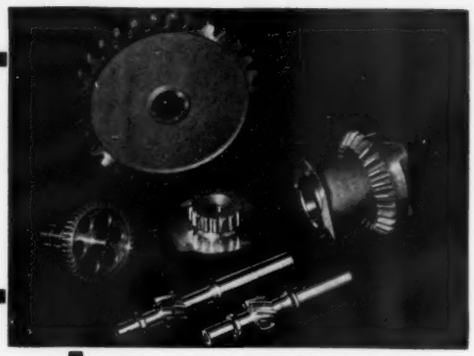
for *Precision* requirements



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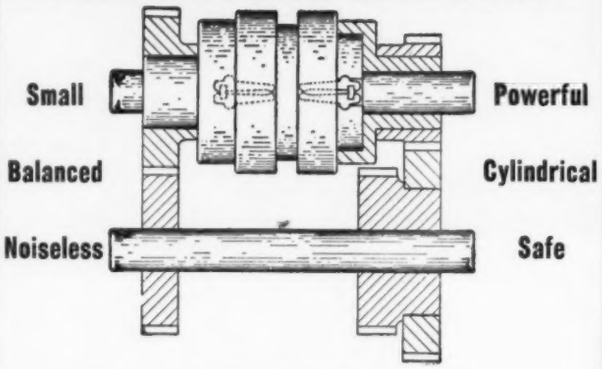

Johnson Double Clutch as used in a gear box

JOHNSON FRICTION CLUTCHES furnish definite protection to spur gear drives. Their smooth action in picking up the load, their dependable action in carrying overloads without slipping or vibration result in shockless power application and transmission.

All of which means longer life, and lower maintenance not only for JOHNSON CLUTCHES but less wear and tear on gears as well as the entire transmission system.

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Write for 1940 Blue Clutch Catalog No. 103 covering expanding ring clutches and our literature covering the "MAXITORQ" floating plate disc type.

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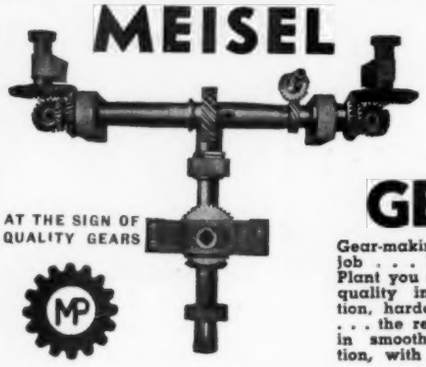

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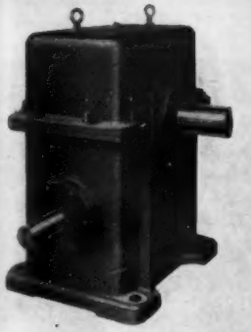
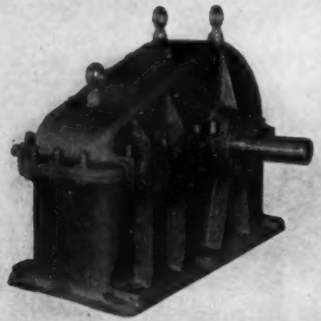


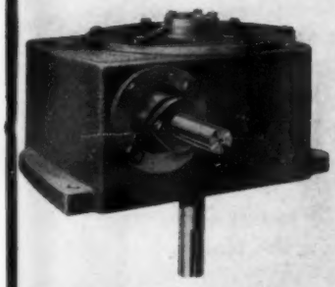
eavy Duty Worm Gear Reducer
Horizontal Drive
Ratios 6 to 65:1 1/8 to 150 H. P.



Continuous Tooth Herringbone Reducer
Single, Double or Triple
Ratios 2 to 350:1 1 to 800 H. P.

Planetary Gear Reducer
Horizontal or Vertical Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.

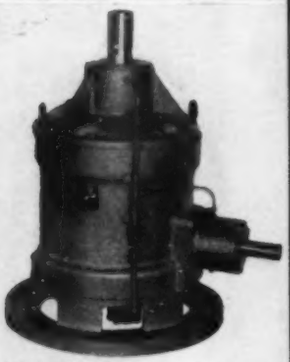
Right Angle Spiral Bevel-Planetary Reducer
Horizontal Drive
Ratios 8 to 1200:1 3/4 to 50 H. P.



eavy Duty Worm Gear Reducer
Vertical Drive
Ratios 6 to 65:1 1/8 to 150 H. P.

Right Angle Spiral Bevel-Herringbone Reducer
Ratios 6 to 45:1 2 to 250 H. P.

Right Angle Spiral Bevel Gear Reducer
Horizontal or Vertical Drive
Ratios 1 to 6:1 3 to 275 H. P.



Spiral Bevel Planetary Reducer
Vertical Drive
Ratios 8 to 1200:1 3/4 to 50 H. P.

Motorized Helical Reducer
Horizontal or Vertical Drive
Ratios 1.2 to 9:1 3/4 to 50 H. P.

Motorized Planetary Reducer
Horizontal Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.

Motorized Planetary Reducer
Vertical Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.

Motorized Worm Gear Reducer
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Ratios 6 to 80:1 1/8 to 50 H. P.

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SPURS
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14 to 96 D. P.
RACKS
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WORM-GEARING

—such as these, and numerous others, are the logical product of a skilled organization with a deft 'feel' for *precise* work. . . . Note the *Combination* Worm-gear, rotating as a Gear on one side and as a Worm on the opposite side.

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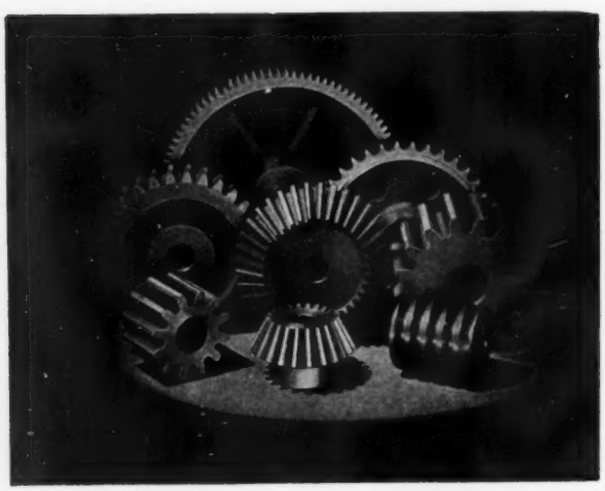

Grant Gear makers recognize that no machine can be better than its gears. For special or standard gears you will find complete satisfaction in Grant Gears and Grant service.

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can be changed by merely changing the pinion.

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All Types and Sizes

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Heat Treated Alloy Steel Gears to Customer's Specifications

Special Gears and Special Gear Units

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Worm gears in any practical size

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FIRST CALLED

"impossible"

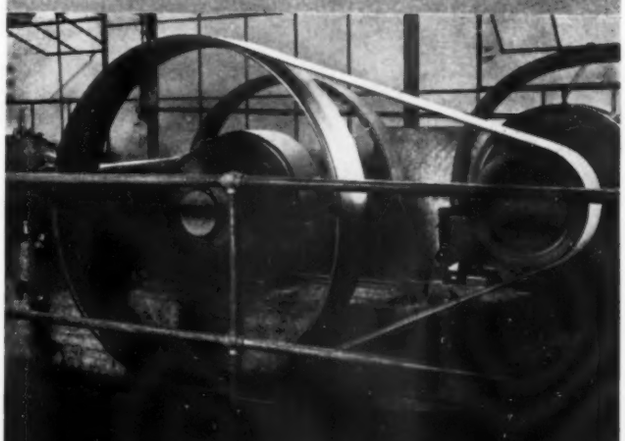
NOW CALLED

"a perfect drive"

● It is a compressor drive used by a maker of mechanical toys. "Impossible" was the forecast when TANNATE was suggested, but a trial was made despite the unfavorable conditions.

That was over *six years ago* and TANNATE is running still, with a gratifying performance record . . . with a grip, flexibility, capacity, and endurance called "perfect"!

It is this sort of reliable service that recommends TANNATE to your attention. If you have a "problem drive," get in touch with us.



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WATERSHED LEATHER BELTING

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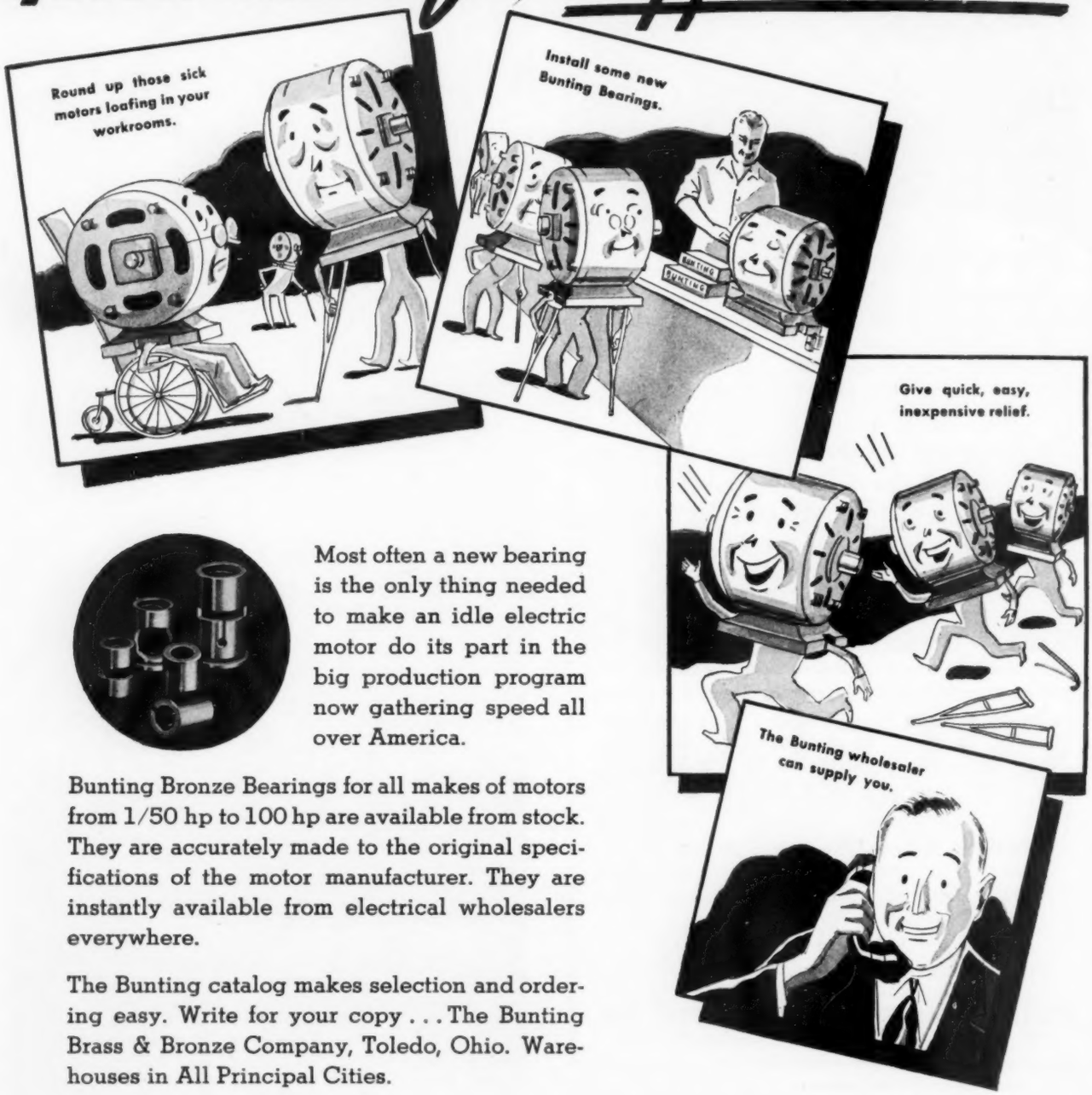
QUICK RELIEF *for Crippled Motors*


Round up those sick motors loafing in your workrooms.
Install some new Bunting Bearings.
Give quick, easy, inexpensive relief.
The Bunting wholesaler can supply you.

Most often a new bearing is the only thing needed to make an idle electric motor do its part in the big production program now gathering speed all over America.

Bunting Bronze Bearings for all makes of motors from 1/50 hp to 100 hp are available from stock. They are accurately made to the original specifications of the motor manufacturer. They are instantly available from electrical wholesalers everywhere.

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● Our mechanical, metallurgical and research engineering staffs are available to you without cost or obligation for development work in bearing alloy and design. Let us quote on your blueprints.

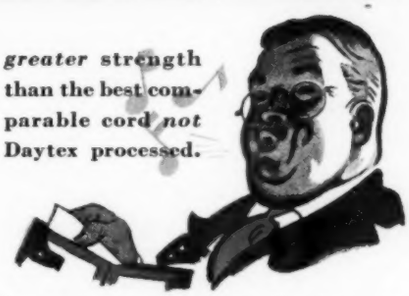
● Also available from stock are hundreds of sizes of completely finished Bunting Bronze Bearings for production and maintenance of industrial machinery, and Tubular and Solid Bearing Bronze Bars machined I. D., O. D. and Ends. Catalog gives complete data and prices. Ask for it today.

BUNTING

BRONZE BUSHINGS · BEARINGS
PRECISION BRONZE BARS · BABBITT METALS

Because Dayton V-Belts with Daytex Cord in their neutral axis section have *less* stretch, they are cooler running and they stand up *longer* under the strain of constant high speed flexing. And that means that your power dollar stretches farther to give you lower cost per-month-of-service.

Wherever power is used you will find proof of the fact that Daytex Cord *does* have *less* stretch, *longer* life and *greater* strength than the best comparable cord *not* Daytex processed.



In thousands of field applications—in all climates and under all conditions, cooler running Dayton V-Belts deliver more output at less cost. What's more, they save time, machinery—and reduce adjustments to a negligible minimum.

Dayton V-Belts are outstanding in basic design because they are the only belt with patented built-to-bend construction. They work on short centers—they save space—maintain machine speed and prevent power waste. Ask your local Dayton distributor for catalogs, data and "The Picture Story of Daytex Cord."

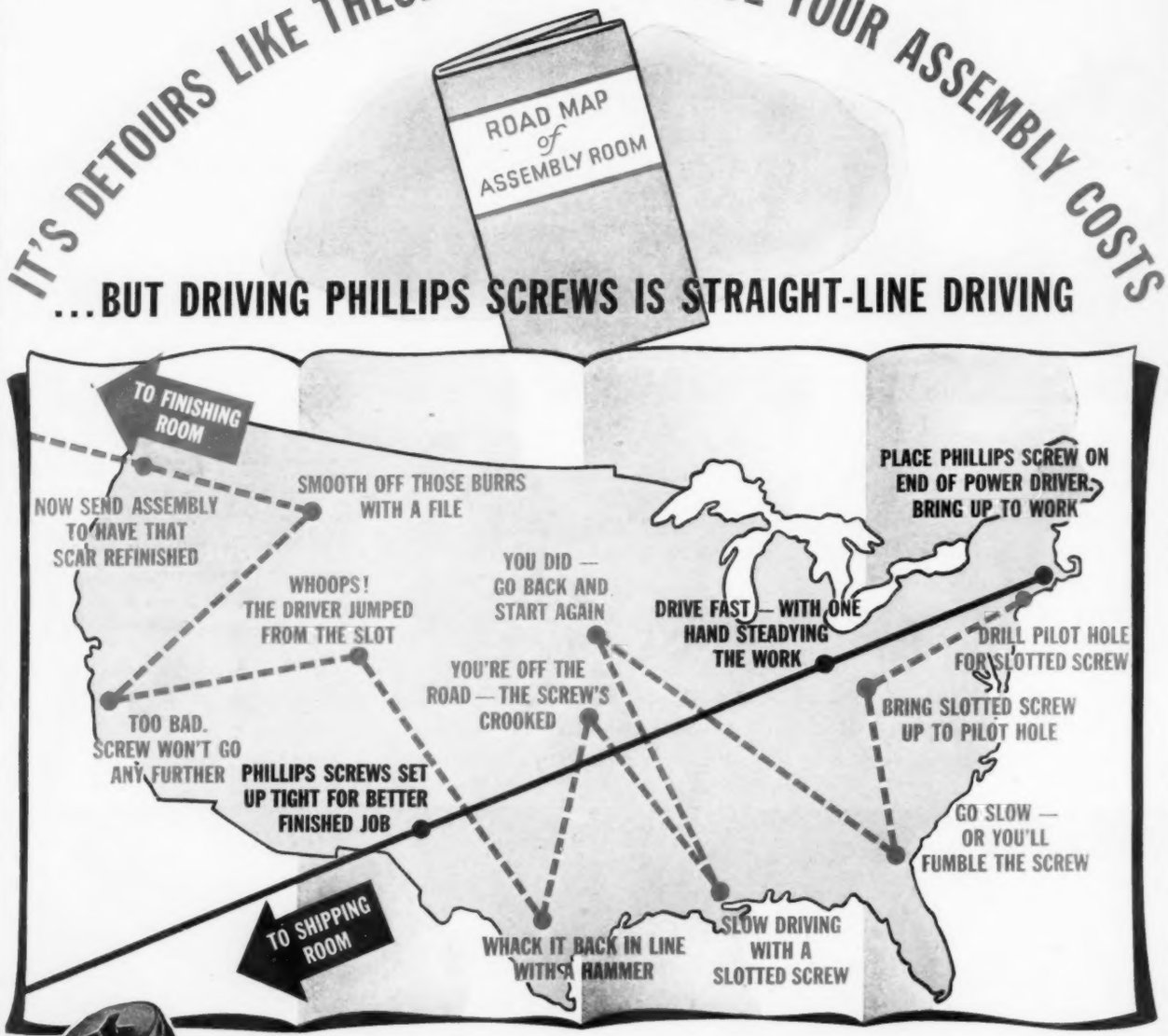
* * *

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON, OHIO

Dayton
V-BELT DRIVES
WITH DAYTEX CORD
THE ONLY BELT WITH PATENTED BUILT-TO-BEND CONSTRUCTION
MADE BY THE WORLD'S LARGEST MAKERS OF V-BELTS

IT'S DETOURS LIKE THESE THAT INCREASE YOUR ASSEMBLY COSTS

...BUT DRIVING PHILLIPS SCREWS IS STRAIGHT-LINE DRIVING


ROAD MAP of ASSEMBLY ROOM
TO FINISHING ROOM
NOW SEND ASSEMBLY TO HAVE THAT SCAR REFINISHED
SMOOTH OFF THOSE BURRS WITH A FILE
PLACE PHILLIPS SCREW ON END OF POWER DRIVER. BRING UP TO WORK
WHOOPS! THE DRIVER JUMPED FROM THE SLOT
YOU DID — GO BACK AND START AGAIN
DRIVE FAST — WITH ONE HAND STEADYING THE WORK
DRILL PILOT HOLE FOR SLOTTED SCREW
YOU'RE OFF THE ROAD — THE SCREW'S CROOKED
BRING SLOTTED SCREW UP TO PILOT HOLE
TOO BAD. SCREW WON'T GO ANY FURTHER
PHILLIPS SCREWS SET UP TIGHT FOR BETTER FINISHED JOB
GO SLOW — OR YOU'LL FUMBLE THE SCREW
TO SHIPPING ROOM
WHACK IT BACK IN LINE WITH A HAMMER
SLOW DRIVING WITH A SLOTTED SCREW

Phillips Recessed Head Screws cut assembly time an average of 50%. Driver and screw fit — no driver slippage with power drivers, more contact for easier turning, no burrs. Phillips Screws set up tighter without pilot holes, and with no danger of split heads.

How much would a 50% saving in assembly time mean in your plant? Add the saving in number of screws used (or smaller, lower-cost sizes), the elimination of expense for locking devices and the freedom from returns due to loosening of the product in use . . . and you'll see why thousands of manufacturers find it costs less in both time and money to use Phillips Screws.

PHILLIPS RECESSED HEAD SCREWS...

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS
SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

Speed Product Deliveries by Cutting Assembly Time

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

American Screw Co., Licensor, Providence, R.I.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corporation, New Britain, Conn.
The Lamson & Sessions Co., Cleveland, Ohio
National Screw & Mfg. Co., Cleveland, Ohio
Parker-Kalon Corporation, New York, N. Y.
Pheoll Manufacturing Company, Chicago, Illinois
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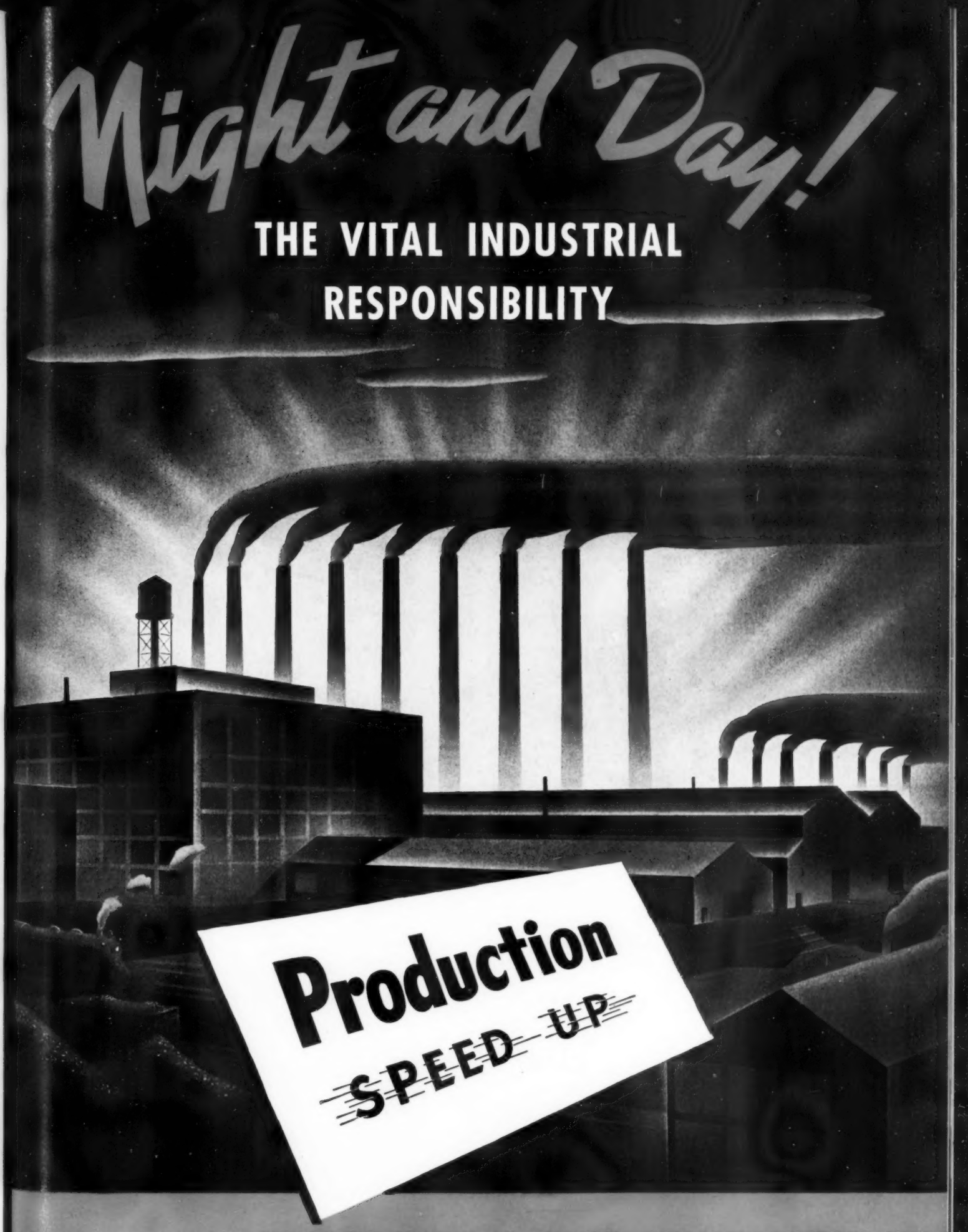
Night and Day!

THE VITAL INDUSTRIAL RESPONSIBILITY



A PRODUCT THAT HAS HELPED OTHERS CAN HELP YOU

(See other side)

IN CUTTING STAINLESS STEEL

...a change to TYCOL CUTTING OIL increased production from 5 pieces to 12 pieces between tool dressings

A good many of the machines that this textile machinery company is making are of stainless steel or have parts made of the same material. One of the parts is a flange of stainless steel that is made in several different sizes. An average one has a hollow shaft of 4 or 5 inches, threaded on the inside. » » » With the cutting oil formerly used the best the company could do was to turn out 5 pieces with one dressing of the cutting tool. However, since switching to Tycol, production has been stepped up to 12 pieces. » » » In your plant, too, you can make worthwhile gains in the savings in tool life, in finer finishes, and increased production. Switch to TYCOL CUTTING OILS. Our engineers will be glad to give you further details of Tycol's complete line "engineered to fit the need." Write for all the facts.

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EASTERN DIVISION
17 Battery Place • New York, N. Y.
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

INDUSTRIAL TYCOL OILS-GREASES

TRANSPARENT
NON-TARNISHING
SULPHURIZED

TIDE WATER CUTTING OILS

THERE IS A COMPLETE LINE OF TYCOL LUBRICANTS SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

5 horsepower Century motor driving a grinding machine.

Get the *Plus Value* of Good Balance in Century MOTORS

● Due in part to their remarkable freedom from electrical and mechanical vibration, throughout the country machine tool users are giving increasing preference to Century Motors.

Good balance helps maintain close tolerances in the finished product by not handicapping the maximum machine tool performance.

For 37 years Century has devoted its time and ability to the design and manufacture of electric motors to meet the specific needs of industry. Century Motors include a wide variety of types and sizes from fractional to 600 h. p.

As a result of Century's years of specialization and its extensive motor line, you are assured of the *correct* electric motor to meet the operating requirements of practically every industrial application. And because the motor fits the job, you get better performance, higher quality of work at the lowest operating cost.

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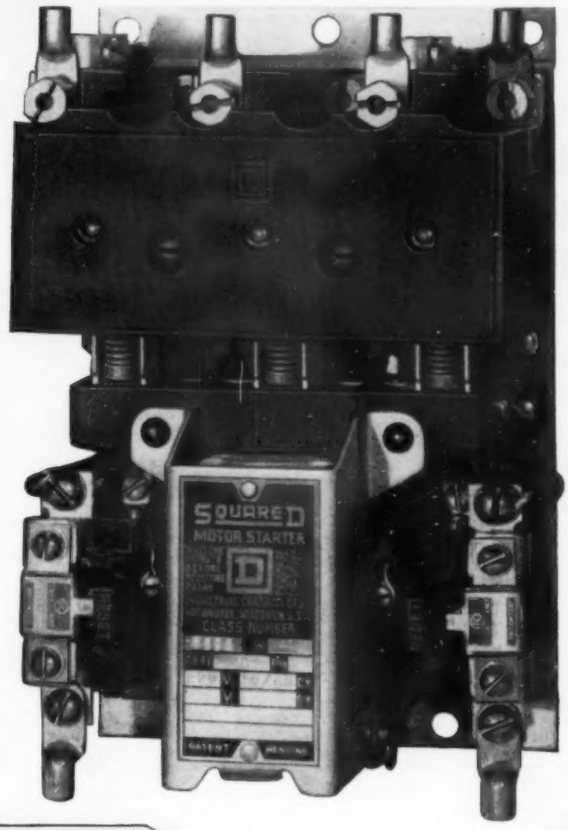
A LINE OF STARTERS DESIGNED TO MEET TODAY'S REQUIREMENTS



DEPENDABLE. Electrically and mechanically these starters are built to withstand the severe service of high speed production methods.

EASY TO WIRE. Enclosing cabinets of all types and sizes provide ample wiring space. Sheet steel cabinets have knockouts at top, bottom, both sides and back. Cast metal enclosures have threaded conduit entrances at top and bottom. Terminals are accessible and clearly marked. Starter is wired in two colors for easy identification of control and power circuits. Thermal relays in plain view for checking current ratings.

ACCESSIBLE. All renewable parts can be inspected or replaced with minimum of time and labor. Contacts, springs and magnet coils are renewable without disturbing any line or load connections.

VERTICAL OPERATION. Straight line vertical action from magnet to contacts eliminates flexible leads, permits compact design and prevents accidental closing.

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ENCLOSED ARC CHAMBERS confine such arcing as may occur. The higher rated contactors have magnetic yokes which act as blowouts—an exclusive Square D feature.

MAGNET. A modified "E" type construction gives exceptional pick-up and sealing characteristics even at low voltage. Two shading coils minimize magnetic hum.

For complete information write for new bulletin No. 137.

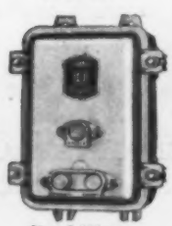
STARTERS IN SIZES UP TO 50 H.P., 440-550 VOLTS
MECHANISMS INTERCHANGEABLE FOR ALL TYPES OF ENCLOSURES

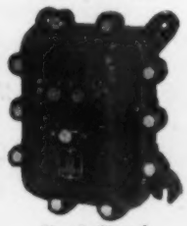
Size 2 General Purpose Enclosure

Size 2 Dust-Tight Enclosure

Size 2 Water-Tight Enclosure

Size 2, Class 1, Group D Enclosure


Size 1 Water-Tight Enclosure

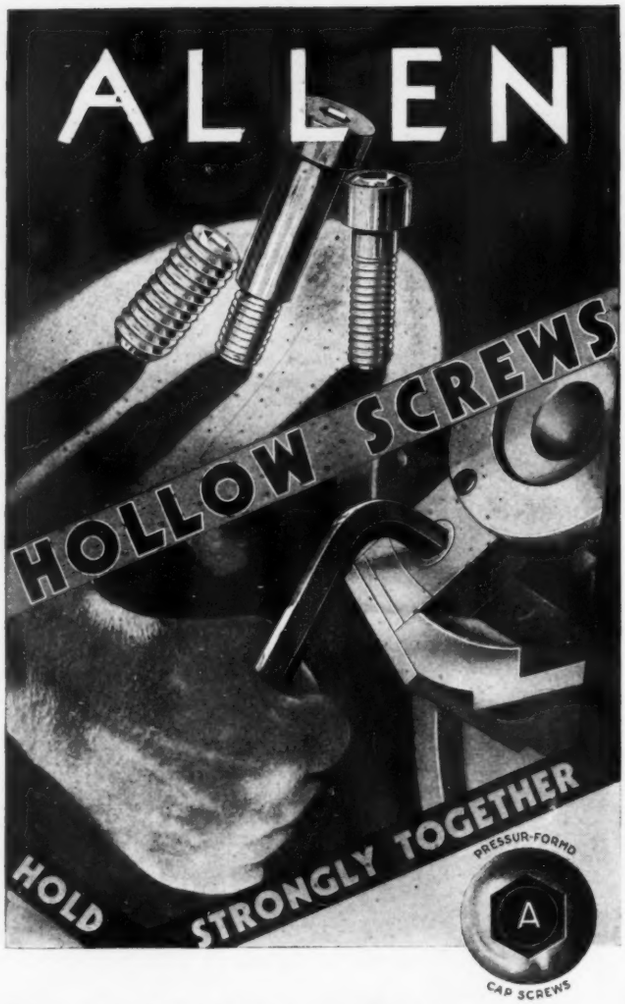

Size 1, Class 1, Group D Enclosure

CALL IN A SQUARE D MAN

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO



Grasp the IN-tangibles too

Engineering departments have every facility for testing hollow screws, but no apparatus for testing the durability of Ideals or the permanence of high standards on the part of the manufacturer.

Let us remember that MEN give a product its character. They even give it *their* character, their integrity, their dependability. In *it* they reflect their own ability to "last".

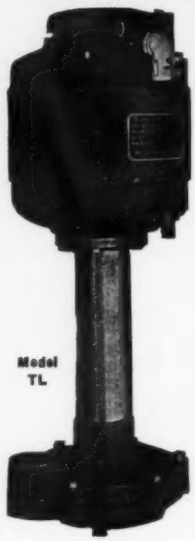
A mere technical innovation may give temporary prominence to a new product. But consistent progress over many years proves a steadfast purpose to improve and perfect at all costs,—itself a guarantee that no work of today, however good, shall be good enough for tomorrow.

You may take the 30-year record of ALLEN as underwriting the integrity of a product which expresses nothing quite so much as the STRENGTH of our loyalty to your requirements.

Your local Allen Distributor will oblige with samples and SERVICE.

THE ALLEN MANUFACTURING COMPANY
HARTFORD, CONN., U. S. A.

TODAY'S PUMP FOR TOMORROW'S MACHINES



RUTHMAN
GUSHER
COOLANT PUMPS

The present trend is to simplify machine tools, to make them more compact and in reality beautify them. Ruthman Gushers make it easy for the designer to do this. Models up to 200 G.P.M.

Gushers are easily mounted, ball-bearing equipped, hydrostatically balanced, self-cleaning, and grit and abrasives pass through them without harm.

Tested, approved and specified as standard equipment by leading machine tool builders.

Write for engineering data and specifications.

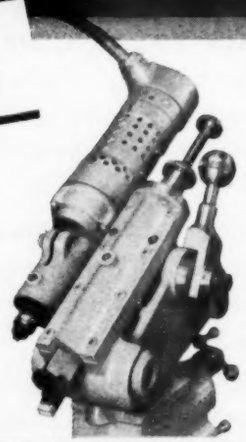
THE RUTHMAN MACHINERY CO.
201 PIKE ST., CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

NEW SUPERFINISHING ATTACHMENT★★

SIZES FOR ANY SHOP LATHE

● Allows you to meet the growing and profitable demand for Superfinished surfaces on a wide variety of ground fractional-inch work. Larger sizes at reasonable cost enable you to do Superfinishing on reamers, gauges, rolls, crankshaft bearings, etc. Valuable explanatory booklet on these attachments sent free to anyone interested in Superfinishing.

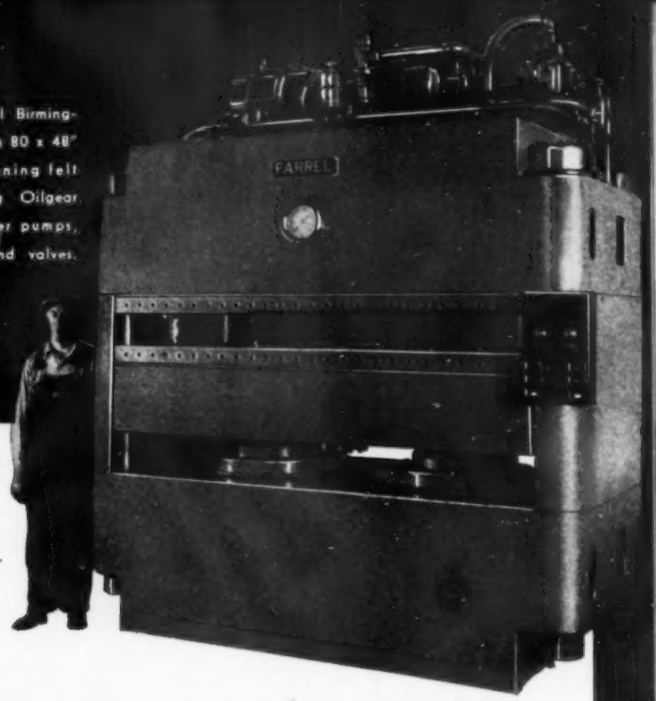
FOSTER MACHINE CO.
1001 Foster Bldg., Elkhart, Ind.



The No. O Foster Inclined Type Superfinishing Attachment fastens to lathe carriage. Superfinish of 2 to 4 micro-inches easily obtained on fractional inch work.

FOSTER

Fitchburg Engineering Corp. special Duplex Milling Machine. One of several types using 100% Oilgear pump, cylinder and valve integral with remote control features.



Right: Farrel Birmingham 226-ton 80 x 48" single opening felt press, using Oilgear Fluid Power pumps, cylinders and valves.

There is no time for "*Time Out*" these days

Today, as never before, it is essential that production machines go right into production and *stay* in production. Busy factories have no time for "Time Out." Machine tool and machinery manufacturers themselves can't afford service complaints.

And so, machine tool and machinery manufacturers insist on having 100% Oilgear Fluid Power Equipment. They know a hydraulic system can be only as good as the pump and the cylinder and the valves. They know that all of Oilgear's unequalled experience in hydraulics goes into the design and construction of all of Oilgear Equipment. And they know that "100% Oilgear Equipped" is the strongest assurance of service they can offer their customers. Unequalled advantages result from this undivided responsibility which rests on Oilgear's leadership and fluid power achievements.

From a broad line of standard Fluid Power Equipment, Oilgear Engineers bring you "tailored to order" results that realize every objective you have in mind . . . a system that is simple to connect, operate and inspect. Oilgear *solutions protect machine manufacturers and users from every standpoint.* The urgency of the times calls for *dependable* Oilgear Fluid Power systems. Write for completely descriptive literature. THE OILGEAR COMPANY, 1307 W. Bruce Street, Milwaukee, Wisconsin.

OILGEAR

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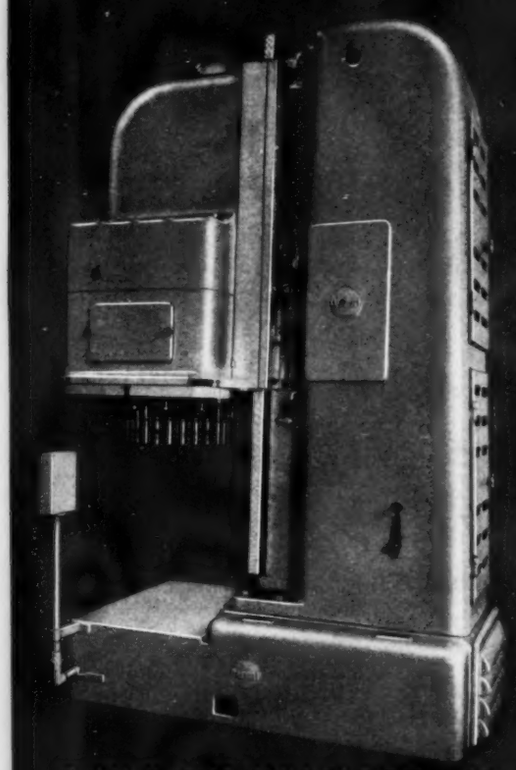
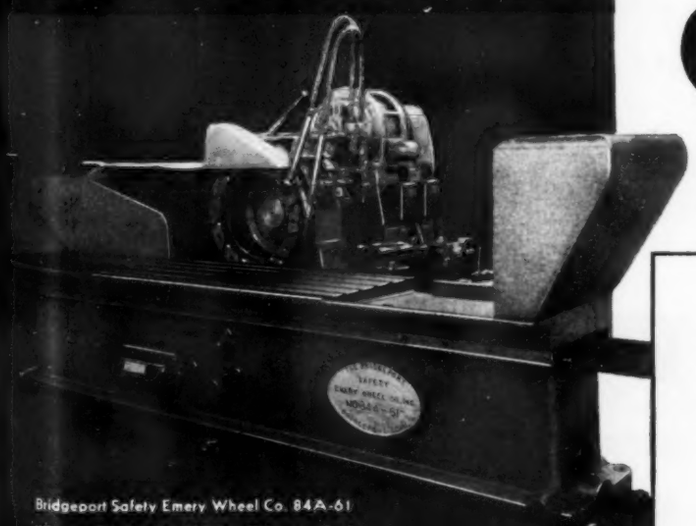
FLUID POWER

Feeds • Pumps • Cylinders • Valves • Motors • Transmissions • Horizontal and Vertical Broaching Machines • Horizontal and Vertical Presses • Custom Built Machines



Bausch Machine Tool Co. Multiple Spindle Drilling and Tapping Machine 100% Oilgear equipped. Said to be the first hydraulic combination machine.



Bridgeport Safety Emery Wheel Co. 84A-61 "Face Grinder." 100% Oilgear fluid power drives table through gear and rack.

OILGEAR

THE MOST EFFECTIVE APPLICATION OF *fluid power*

THE OILGEAR COMPANY, 1307 W. Bruce Street, Milwaukee, Wis.

Please send me a copy of Bulletin 47000 without obligation.

Name .....

Company .....

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TWO PROVEN PRODUCTS

A TYPICAL HIGH SPEED
HARDINGE PRECISION LATHE

WINCHESTER MODEL 70
BOLT ACTION
REPEATING RIFLE

HARDINGE
AND
WINCHESTER
TRADE MARK

hit the "Bulls Eye" *for performance*

The Winchester Repeating Arms Company have selected Hardinge modern machines to play an important part in their production program,

because . . .

the high quality, quick action and accuracy of all Winchester Arms, demanded the same characteristics in the machines used in their manufacture.

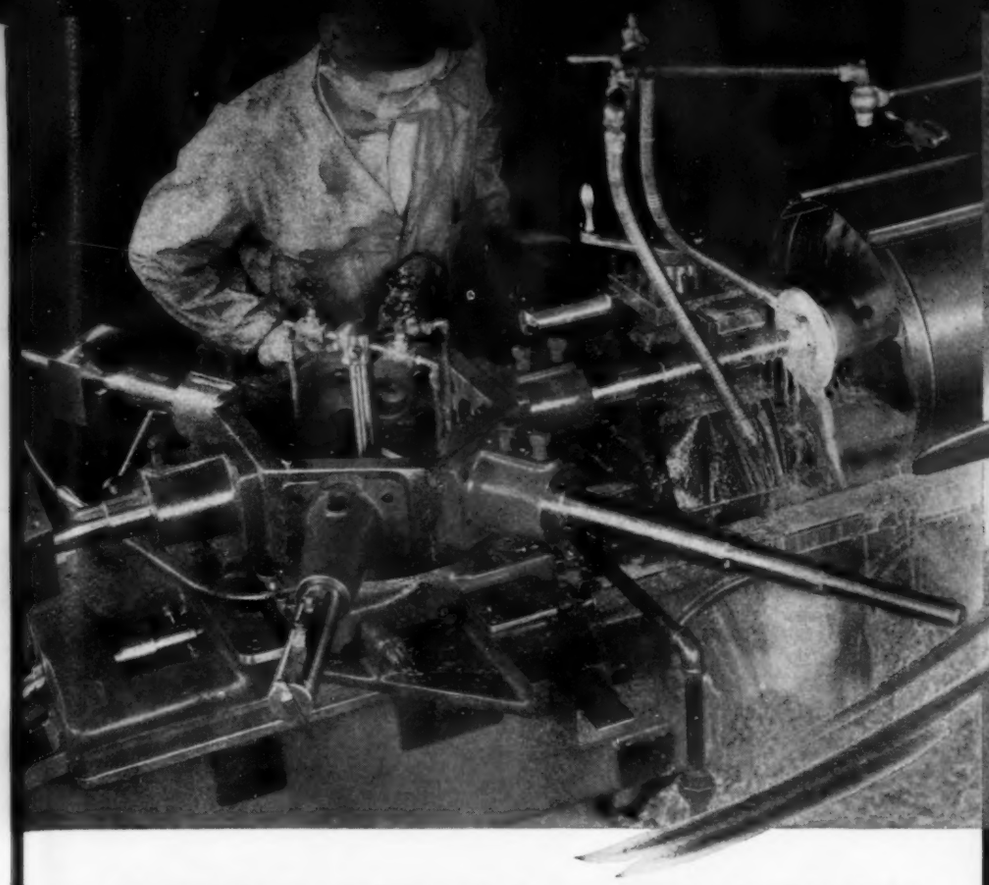
HARDINGE BROTHERS, INC. 50th ANNIVERSARY 1890-1940

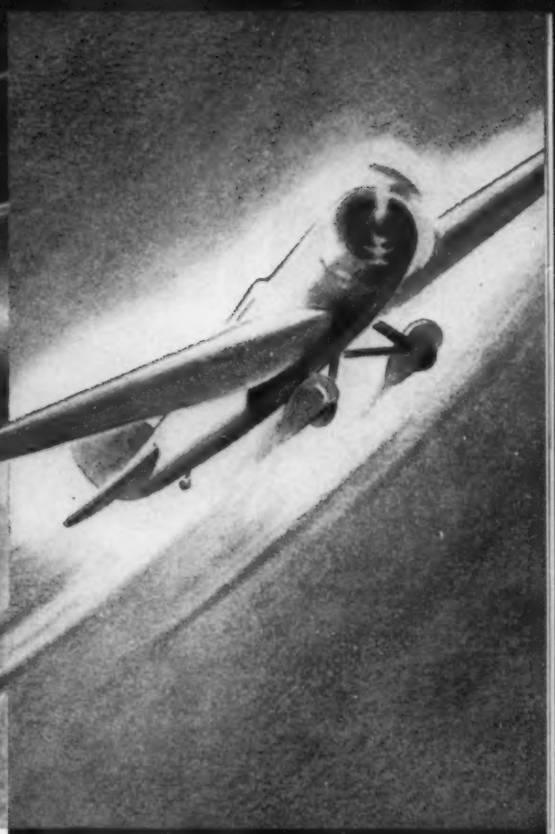
Ask for our Golden Anniversary Bulletin which presents reasons why easy to operate, low cost Hardinge machines will serve you better in your laboratory, tool-room and production work.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

NEW YORK CHICAGO HARTFORD PHILADELPHIA CLEVELAND DETROIT

1890 —— HARDINGE GOLDEN ANNIVERSARY YEAR —— 1940





PRODUCTION ZOOMS!

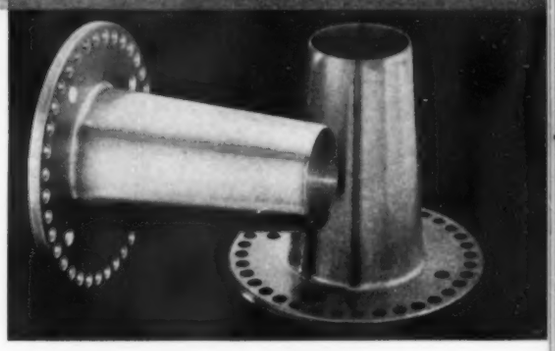
—ON THESE FINELY FINISHED PROPELLER BUSHINGS

● In machining high speed airplane parts, there is no substitute for quality—they *must* be right.

It's one thing to get the required accuracy and fine finish. It's quite another to get it and still keep the manufacturing costs from going sky-high. That's the reason this manufacturer chose the Gisholt 1L High-Production Turret Lathe to machine these propeller bushings.

Some of the outstanding Gisholt features that make such performance possible are: rigid one-piece bed and headstock; solid hardened ways, for accuracy and permanent alignment; quick indexing tool post and power rapid traverse on both carriages for quickly positioning the tools; cross feeding turret, for adaptability to a wide variety of work; and the Gisholt Power Speed Selector with finger-tip control, permitting the operator to obtain the desired spindle speed instantly.

If you are interested in saving money on your machine operations, or stepping up your production, a Gisholt engineer will be glad to discuss your problems with you.



★ *These bushings, used on variable pitch aircraft propellers, are made of hard, wear-resisting bronze, which is very difficult to machine. They are turned with cemented carbide and high-speed steel tools. Extreme rigidity of the Gisholt machine enables this manufacturer to obtain exceptionally close limits, and at unusually high cutting speeds. Notice their mirror-like finish.*

Gisholt High-Production Turret Lathes are completely described in this new bulletin. Your copy will be sent on request.

"YOUR SMARTEST INVESTMENT TODAY—BETTER MACHINE TOOLS"

GISHOLT

GISHOLT

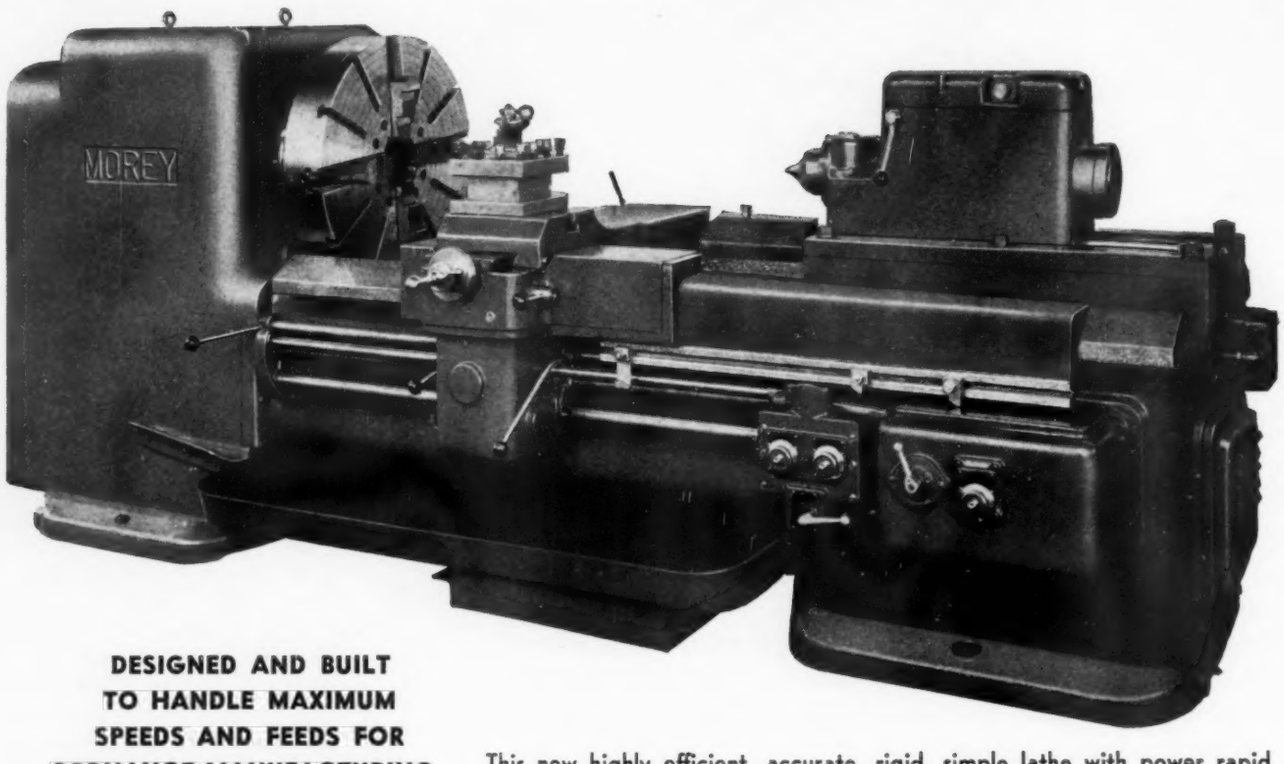
MACHINE COMPANY

1201 EAST WASHINGTON AVENUE, MADISON, WISCONSIN, U. S. A.

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

MOREY Announces

. . A NEW 27"
FINGER TIP CONTROL HEAVY DUTY HYDRAULIC MANUFACTURING LATHE



DESIGNED AND BUILT TO HANDLE MAXIMUM SPEEDS AND FEEDS FOR ORDNANCE MANUFACTURING

This new highly efficient, accurate, rigid, simple lathe with power rapid traverse, will handle single purpose turning operations at the maximum permitted by present day tool steels.

It is assembled from basic units combined to produce a complete line of equipment for manufacturing shells from rough forgings, ready for thread milling. It is also built with hexagon turret having individual stops, mounted on separate saddle.

INVESTIGATE *NOW*

Write at once for detailed specifications of this new Morey lathe which incorporates time-tested, proved and modern mechanical and hydraulic features for the *maximum in efficiency, economy and speed.*

OUTSTANDING FEATURES

Modern in every detail, this new MOREY lathe, particularly designed for ordnance production offers the following outstanding features:

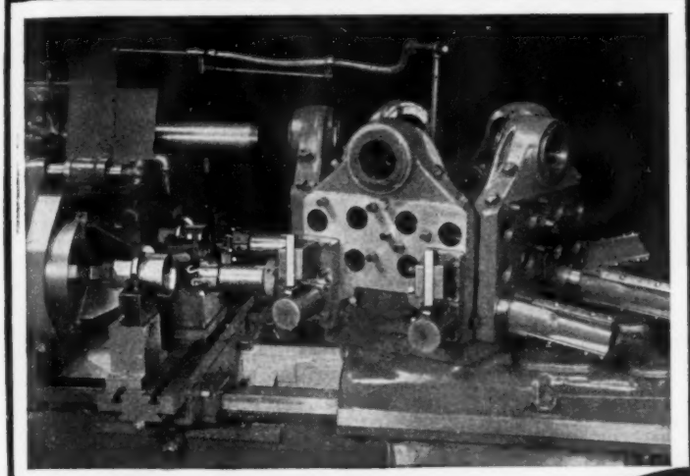
- . . . ANTI-FRICTION BEARING THROUGHOUT
- . . . FINGER TIP CONTROL FOR ALL MOVEMENTS, SPEED, FEED, AND TAILSTOCK
- . . . SPINDLE SPEEDS CAN BE SET UP FOR THE EXACT SPEED REQUIRED BY THE WORK
- . . . CONTROLS INTERLOCKED
- . . . EXACT FEED FOR JOB INSTANTANEOUSLY SELECTED
- . . . RIGID IN CONSTRUCTION — VIBRATION FREE

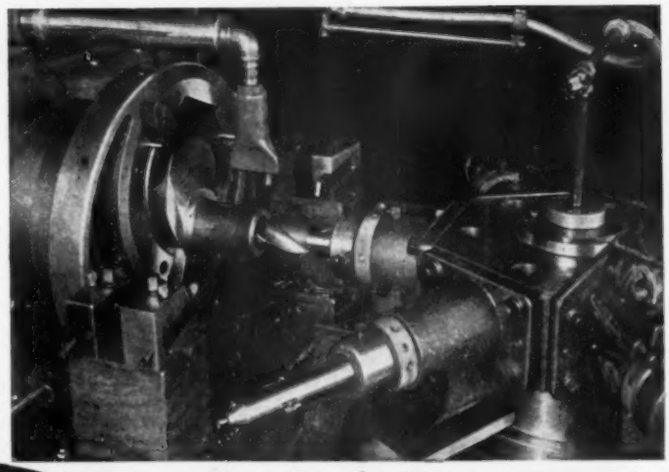
MOREY MACHINERY CO., Inc.

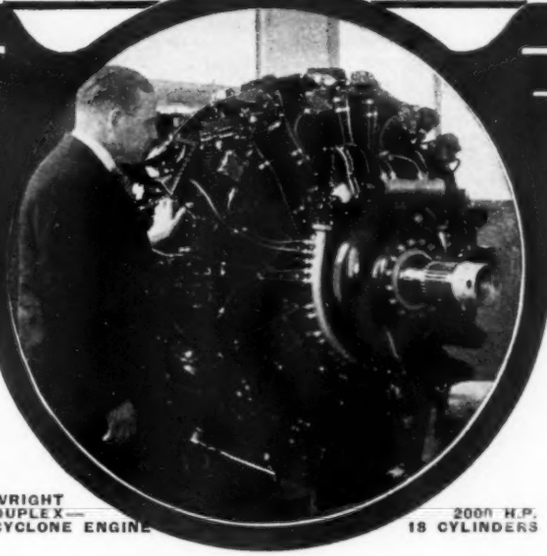
410 BROOME ST. . . . . NEW YORK, N.Y.

P&J AUTOMATICS

PROVIDE SOLUTIONS TO *AIRCRAFT ENGINE PRODUCTION PROBLEMS*







WRIGHT DUPLEX—CYCLONE ENGINE — 2000 H.P. 18 CYLINDERS

5D—TWO SPINDLE POTTER & JOHNSTON AUTOMATIC equipped with specially designed tooling for boring, turning and facing Aircraft Engine cylinder barrels. The set-up illustrated represents one of several methods now in use for economical production.

6 DREL—SINGLE SPINDLE POTTER & JOHNSTON AUTOMATIC, also equipped with special tooling, arranged for the speedy and efficient handling of one of the principal operations on Aircraft Engine crankshafts. Full particulars and complete details will be sent upon request.

AIRCRAFT ENGINE PARTS

CYLINDERS — PISTONS — MASTER RODS — CYLINDER HEADS — CAMS — REDUCTION GEARS — CRANKCASES — CRANKSHAFTS — AND MANY OTHERS ARE ECONOMICALLY PRODUCED AT HIGH RATES OF SPEED ON P & J AUTOMATICS

POTTER & JOHNSTON MACHINE COMPANY

PAWTUCKET, RHODE ISLAND

FACTORY REPRESENTATIVES: William L. Martin, Headquarters at Factory: New England States and Eastern New York and New Jersey; A. W. Stone, 986 Kenyon Ave., Plainfield, N. J.: Western New York and New Jersey, Eastern Pennsylvania, Maryland and Delaware; G. Tell DuBois, 8-154 General Motors Building, Detroit, Michigan: Michigan and the City of Toledo, Ohio; Louis K. Voelk, 3865 Woodridge Road, Cleveland, Ohio: Ohio—with the exception of Toledo, and Western Pennsylvania; Harry I. Schuster, 743 N. Fourth St., Milwaukee, Wisconsin: Illinois, Missouri, Wisconsin, Iowa and Indiana. **AGENCIES:** Star Machinery Company, 1741 First St., South, Seattle, Washington; Henes-Morgan Machinery Co., 2026 Santa Fe Ave., Los Angeles, Calif.; Jenison Machinery Co., 20th and Tennessee Sts., San Francisco; Wessendorff, Nelms & Co., Inc., 320 Franklin Ave., Houston, Texas; Arthur Jackson Machine Tool Co., 60 Front St., West, Toronto 2, Ontario; Arthur Jackson Machine Tool Co., 437 Grosvenor Ave., Montreal, Canada; Burton Griffiths & Co., Ltd., Birmingham, England; R. S. Stokvis et Fils, Paris, France: Rotterdam, Holland and Brussels, Belgium; Maskinaktiebolaget Karlebo, Stockholm 1, Sweden; Ing. Ercole Vaghi, Milano, Italy; Yamatake & Co., Ltd., Tokyo, Japan (Imperial Export Co., 44 Whitehall St., New York, N. Y.); Almacoa, Zurich, Switzerland.

Fastermatics

SAVE 50 TO 90 PERCENT OF MACHINING TIME ★ ★

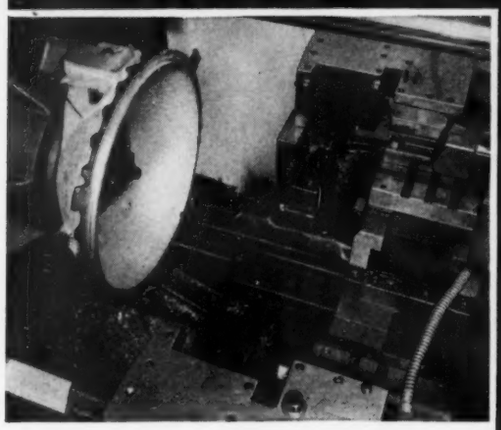
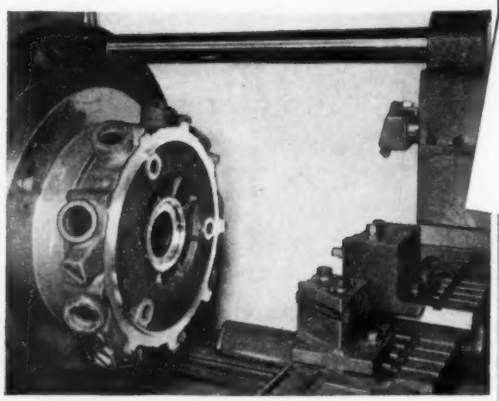


Photo above shows crankcase being finished on a Foster Platen type *Fastermatic* at Wright Aero plant. Both sides are finished, hole for shaft is bored and the back is faced. Excellent finish and close tolerances are maintained.



An aircraft Supercharger housing being machined on a 4-F *Fastermatic*. Both sides are finished, inside bored, and joints are turned. The fixture holding the housing locates the different bosses automatically. While one piece is being finished, operator locates work in fixture on another similar machine.

★

One of the 50 *Fastermatics* now in use at the Wright Aeronautical Corporation plant at Paterson, N. J. This is the 4-F Universal Platen type. Both Platen and Turret types are made in four sizes.

More and more *FOSTER Fastermatics* are being installed by leading airplane engine manufacturers to speed up work on vital defense needs. For instance, 50 units are now in operation at the Wright Aero Plant because they assure accuracy under big production schedules.

Hand operations are reduced to a minimum since automatic features permit one operator to handle several machines. Speeds and feeds being automatically controlled, operator fatigue is reduced. This assures steady production of unvarying high quality even while working at closest possible tolerances.

Savings effected by present users of *Fastermatics* often exceed 50% over previous machining methods, *and in many cases up to 90%.*

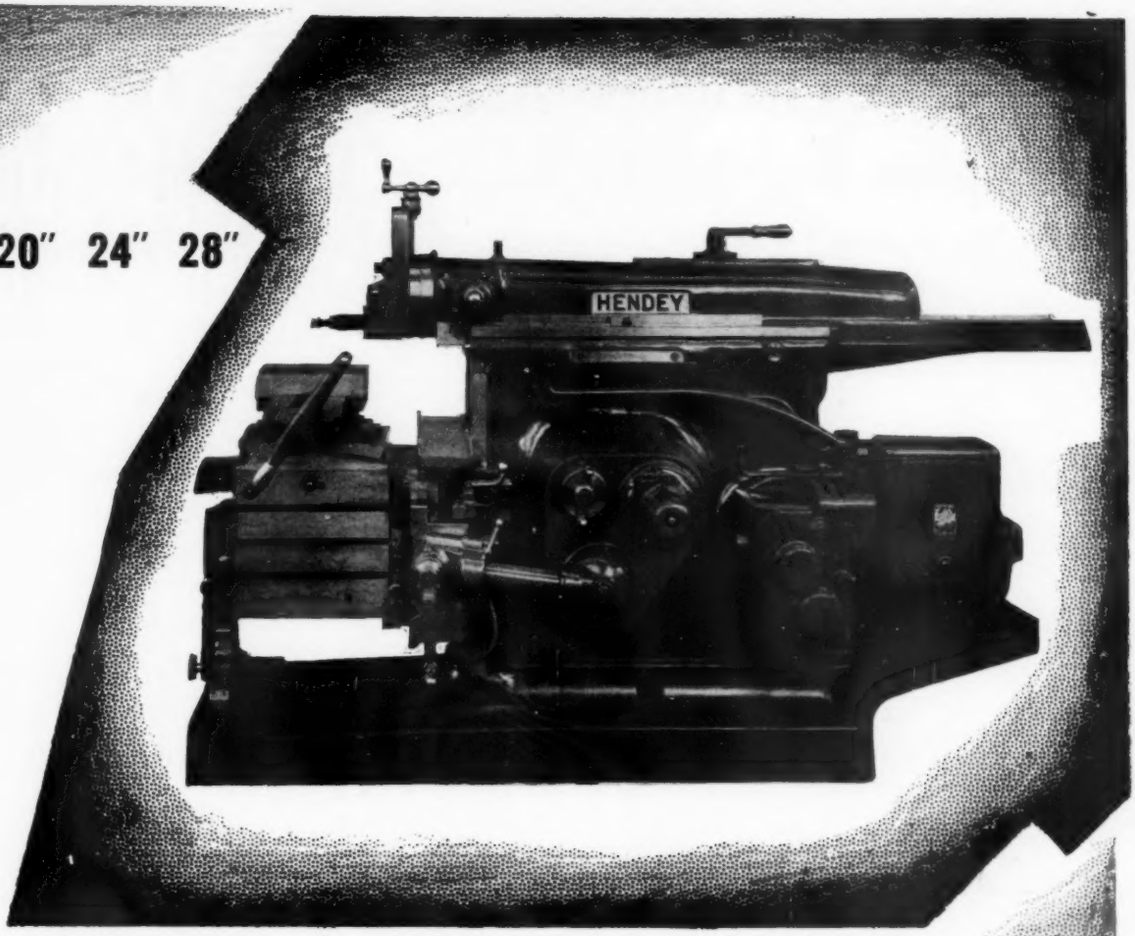
Find out how *Fastermatics* can increase production and save you money in your own plant. Write today for full details and latest literature.

FOSTER MACHINE COMPANY
1001 Foster Bldg., Elkhart, Ind.

FOSTER MACHINE CO., ELKHART, IND.

MANUFACTURERS OF
FASTERMATICS . . TURRET LATHES
SCREW MACHINES . . SUPERFINISHERS

16" 20" 24" 28"



FOR ECONOMICALLY TURNING OUT ALL CLASSES OF WORK AT HIGH CAPACITY • • •

Every class of work coming within their capacity can be handled with maintained efficiency and accuracy on these Hevy Duty Hendey Shapers.

Designed for long, hard, accurate service—with 8 speeds for ram travel, these machines are powerful, convenient and versatile. All details of construction have been developed to insure the maximum in productivity.

Crank gears run on heavy-duty Timken bearings; speed change gears are of alloy steel, heat-treated with tooth profile refinished after hardening; automatic lubrication is applied to the entire driving mechanism. In addition, rapid traverse, and power down feed are available as well as universal table.

STANDARD AND HEVY DUTY CRANK SHAPERS

Complete detailed specifications are available by writing for a copy of Bulletin 16048-S-5.

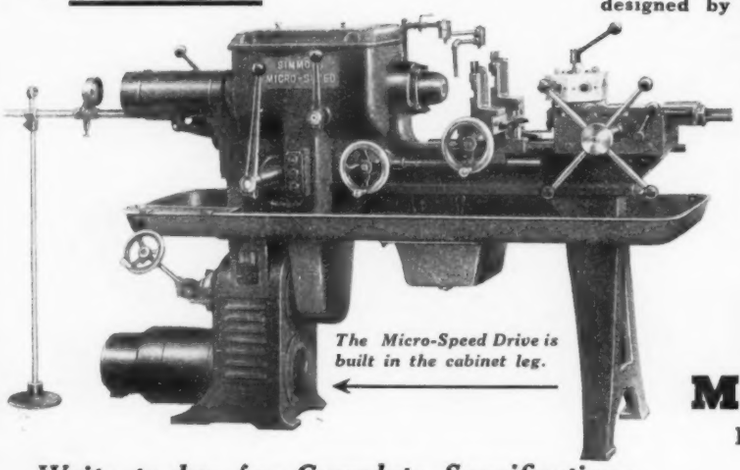
HENDEY MACHINE CO.
Torrington, Conn. *U. S. A.*

HENDEY

Quick Deliveries Assured on the NEW Simmons No. 2 TURRET SCREW MACHINE!

Micro-Speed Drive = **Push Button Control • Magnetic Brake • Speeds to 1500 R.P.M. • Timken Precision Tapered Roller Bearings**

• Low in Cost



The Micro-Speed Drive is built in the cabinet leg.

Here is a splendid machine with unusual quick-production advantages. This tool has been especially designed by Simmons engineers with every modern facility for rapid, accurate output. The workmanship and materials reflect the Simmons standard of quality to the highest degree.

The greatest possible rigidity is assured as the head is cast solid with the bed. The spindle is of high carbon steel and accurately ground to size. By a mere turn of a hand wheel the operator can immediately select the best suited spindle speed for the class of stock that is being machined.

SIMMONS
Machine Tool Corp.

1759 N. Broadway, Albany, N. Y.

EXPORT OFFICE—SINGER BUILDING
NEW YORK CITY

Write to-day for Complete Specifications.

16" and 18"

FEDERAL
MANUFACTURING LATHES

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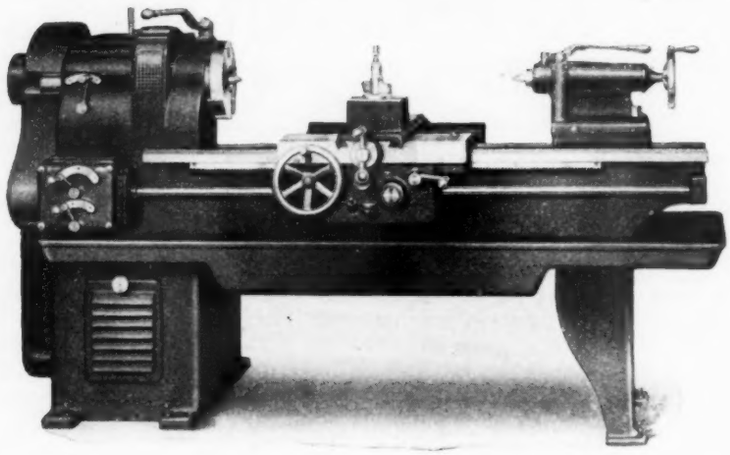
Available for Immediate Shipment



These new lathes are modern, fast, economical and precision built to meet the exacting needs of present day production.

Features include: Selective-speed headstock, flood lubricated; six spindle speeds are provided and are obtained by manipulation of two convenient levers.

Spindle precision mounted on Timken bearings; gears heat treated and hardened of chrome nickel alloy steel.

Nine feed changes controlled by two levers.

Bed of inverted "V" type, heavily cross-braced; apron of single piece box type construction, accurately tongued to carriage; V-belt drive from constant speed motor in base.

Built by
Le BLOND ENGINEERING CO.
Cincinnati, Ohio

Investigate

the many features offered by writing for descriptive bulletin, sent promptly on request.

CONDENSED SPECIFICATIONS

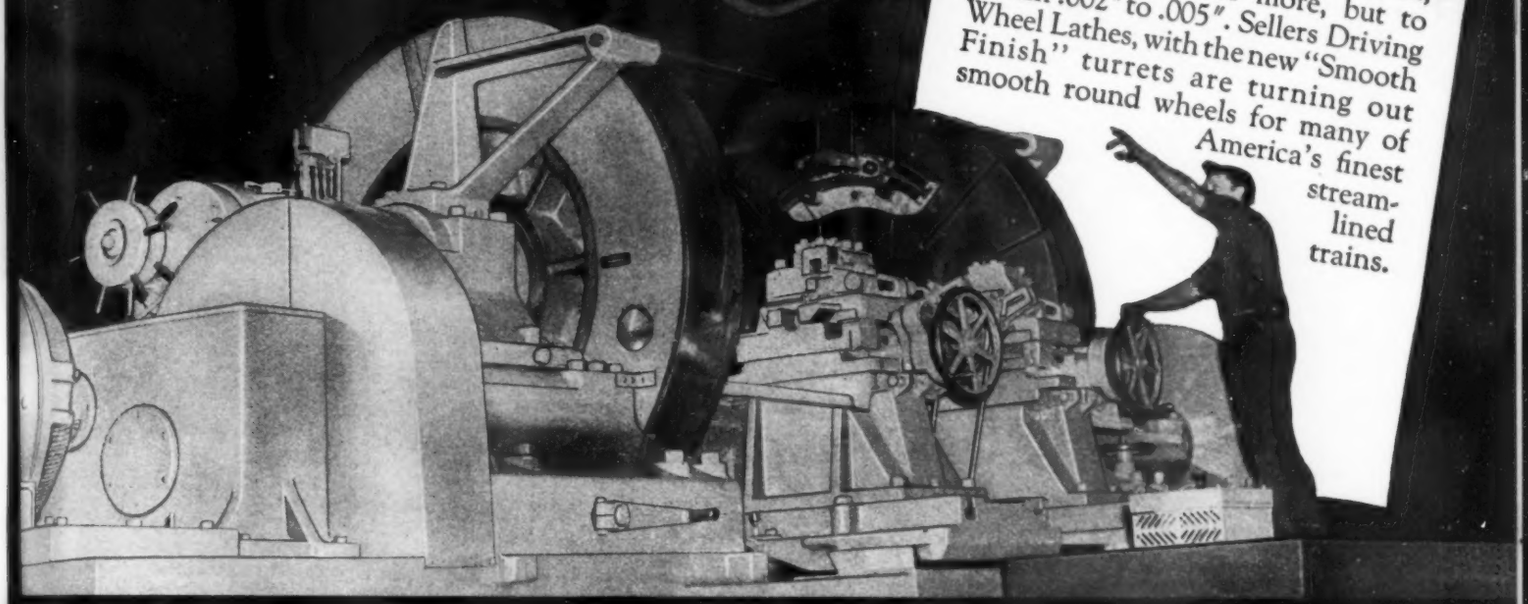
Swing over ways: 18" and 20" for 16" and 18" models respectively.
Maximum distance between centers, 32"—6' bed.
Spindle speeds: 6: range: 75 to 375 R.P.M.
Feeds: cuts per inch: .010 to .100.
Net weight: 16" 2850#: 18", 3000#.
Export Shipping Weight: 16", 3350#: 18", 3500#.

GERARD MACHINE COMPANY, INC.
60 Park Place, NEWARK, N. J.

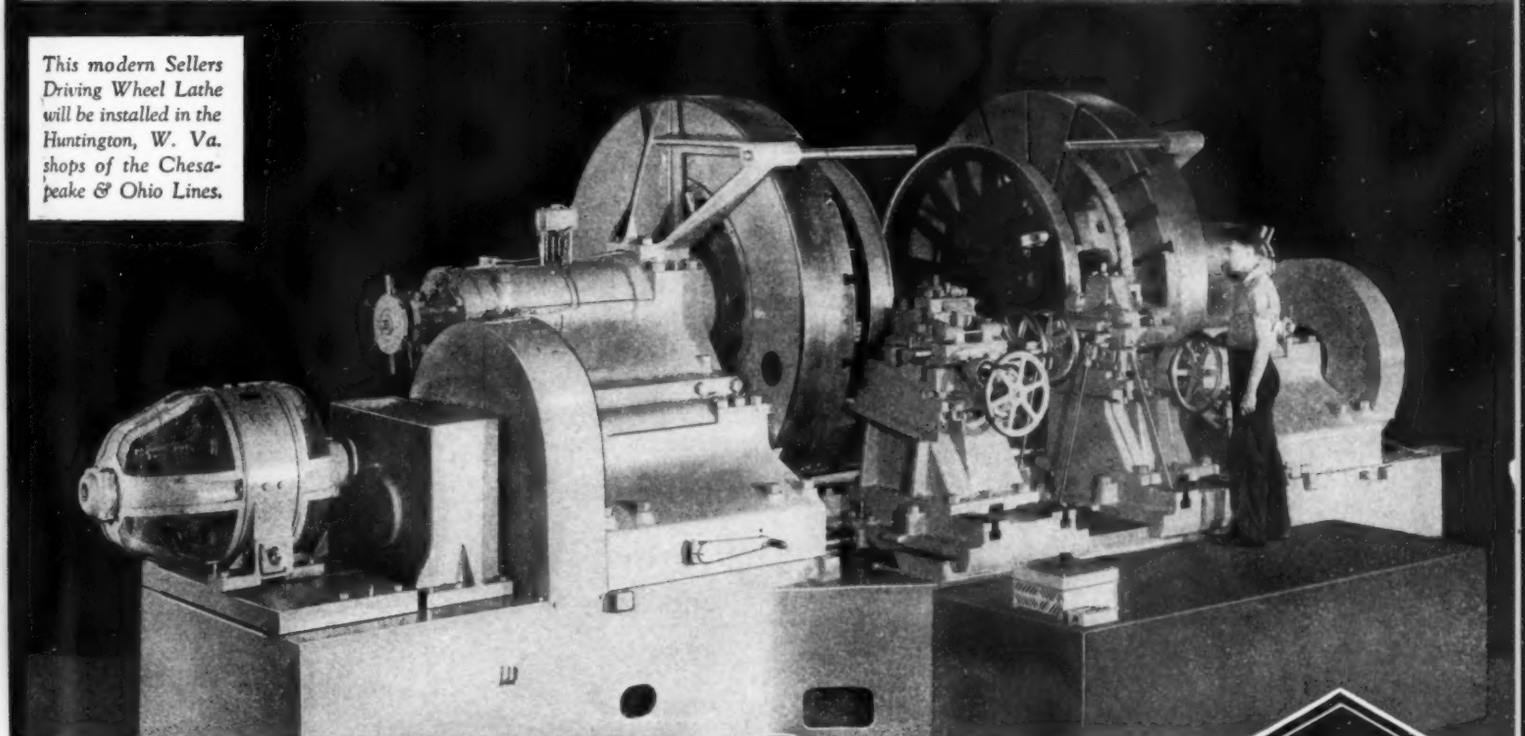
Round *Smooth Finish* Driving Wheels

HIGH-SPEED SCHEDULES CAN BE MAINTAINED ONLY ON ROUND WHEELS

TODAY's railroad schedules have made obsolete a lot of machinery formerly good enough for the slower speeds of yesterday. Driving wheels, as well as car wheels, must be perfectly round, perfectly smooth, not within .015″ or more, but to within .002″ to .005″. Sellers Driving Wheel Lathes, with the new "Smooth Finish" turrets are turning out smooth round wheels for many of America's finest streamlined trains.



This modern Sellers Driving Wheel Lathe will be installed in the Huntington, W. Va. shops of the Chesapeake & Ohio Lines.

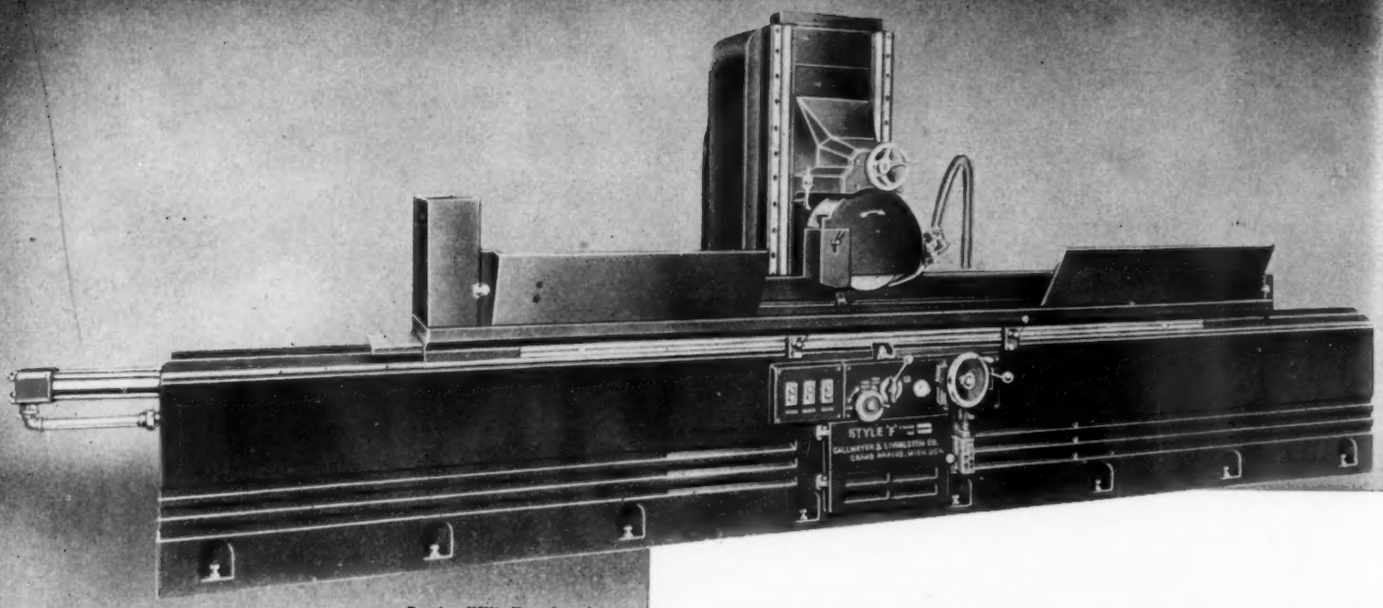


LIAM SELLERS & CO., INCORPORATED • 1610 Hamilton Street • Philadelphia, Pa.

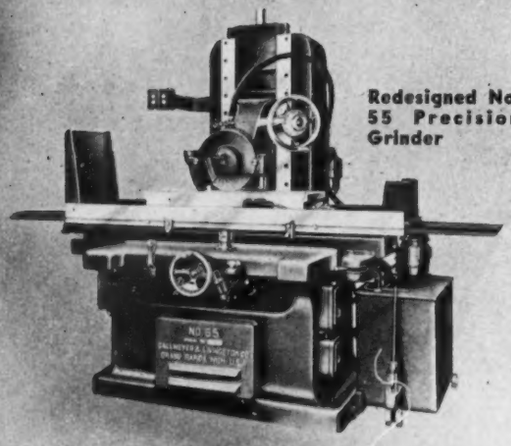
FOUNDED SELLERS 1848

Sellers

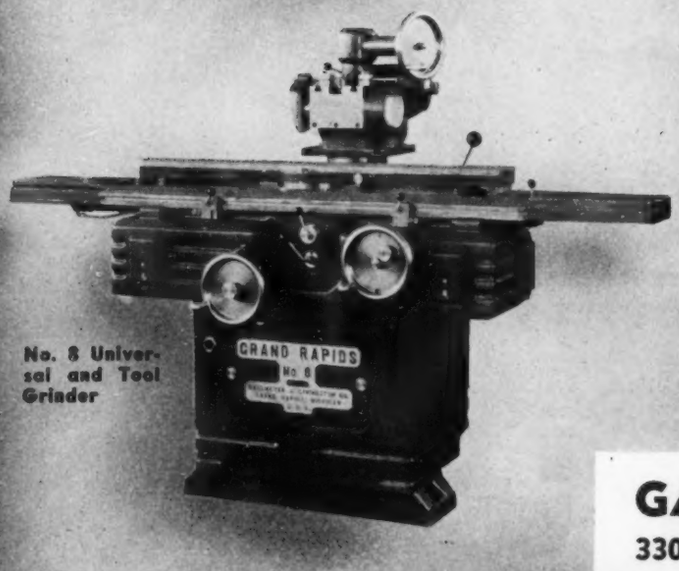
"GRAND RAPIDS"
PRECISION GRINDING MACHINES



Style "F" Production Type Grinder



Redesigned No. 55 Precision Grinder



No. 8 Universal and Tool Grinder

"Grand Rapids Hydraulic Feed Surface Grinders, the result of over thirty years of experience in the building of Precision Grinding Machines, make possible tool room accuracy at production speeds.

"Style F Machines illustrated and described in bulletin GL-108 are obtainable up to 30" x 25" x 144" capacity.

"Precision Tool Room Type Machines illustrated and described in bulletin GL-100 are obtainable up to 14" x 17" x 48" capacity.

"Grand Rapids Hydraulic Feed Universal and Tool Grinders are featured in special circular.

"Printed matter describing the machines in which you are particularly interested is yours for the asking."

GALLMEYER & LIVINGSTON CO.

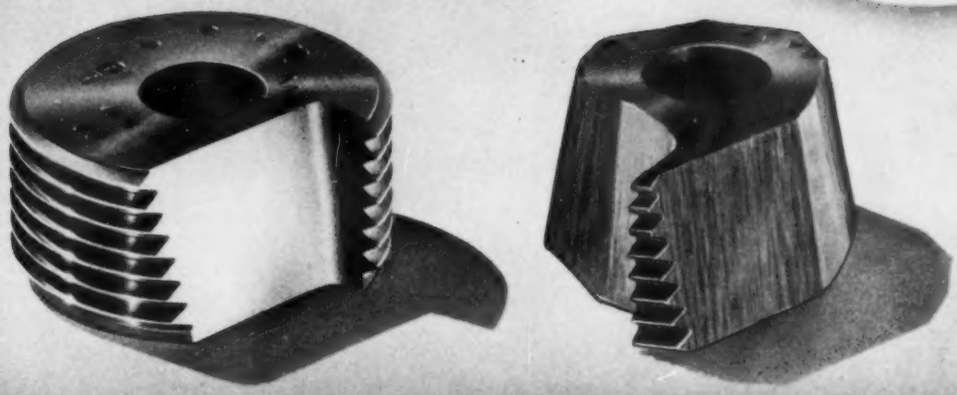
330 Straight Ave., S.W. GRAND RAPIDS, MICH.

1,351,000 *Pieces*

WITH ONE SET

NAMCO *CIRCULAR* CHASERS

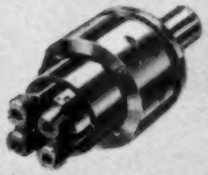
Thread cut on rough diam.
— malleable iron.



Style DS, sizes
3/16"-4⅞"

Style DR, sizes
.056-4⅞"

Style DBS, sizes
.056-9/16"



Style RSP Tap
sizes 2¼-5"

Circular Chasers give 10 TIMES the life of ordinary chasers.

Chaser cost — 2¢ per 1,000 pieces

"And that's something to talk about." So says J. Jacobson, President, Union Malleable Mfg. Company, Ashland, Ohio.

Just how do Namco Circular Chasers get results like this? First, they give you 270° usable grinding surface. The used chaser here shown was ground more than 200 times.

Each chaser is checked before and after each grind with a micrometer fixture. You take off as little as .015" per grind. When you replace chasers in die head they are identical—ready to go. This not only eliminates scrap loss, but minimizes time loss between grinds. You can remove and replace four chasers in less than one minute.

These economies in grinding and time saving, plus the simple rugged construction of Namco precision die heads account for the fact that executives of companies like Union Malleable who couple modern tooling methods with efficient operation are proud to say, "our shop is 100% Namco die equipped."

How about saving on your jobs? Let's find out.

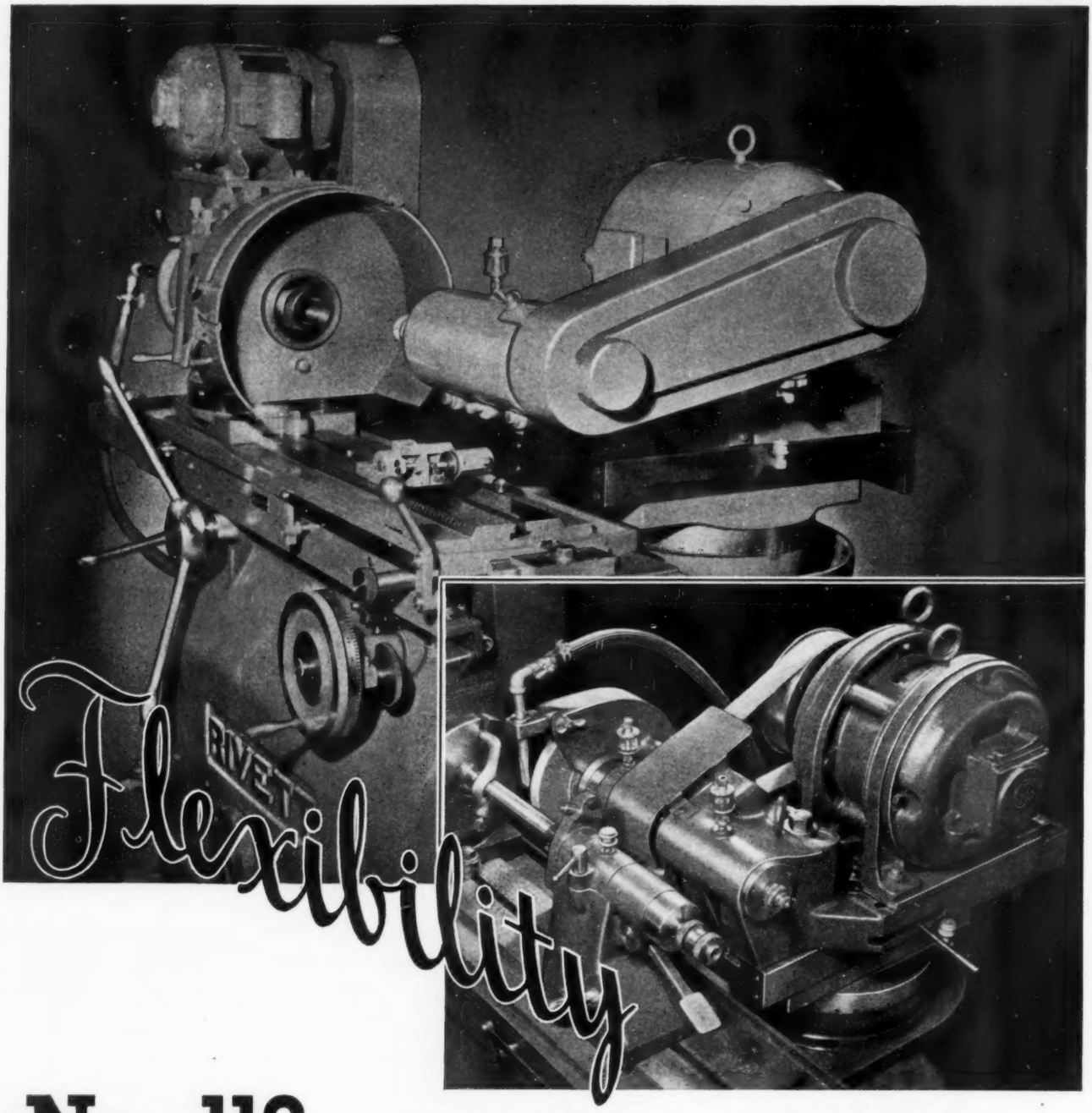
64 page Complete Threading Catalog — D-38. Explains how Circular Chasers and Circular Hollow Milling Cutters are used in same head—

DOUBLE DUTY TOOLS

NATIONAL ACME

170 EAST 131ST STREET • CLEVELAND, O.

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING



No. 112 UNIVERSAL GRINDER

Primarily is for medium and large internal and external tool-room grinding, straight, bevel, two angle or straight and bevel at one setting. Wide range of adjustments makes it effective on a great variety of work while its extreme simplicity of design enables any mechanic to operate it. Complete specifications sent on request.

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

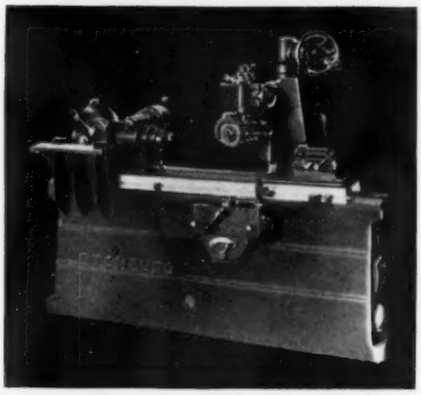
FITCHBURG GRINDERS

ARE MODERN COST-CUTTING MACHINES

based on 35 years specialized experience

THE NEW FITCHBURG PLAIN CYLINDRICAL GRINDER

This recent development by Fitchburg engineers is made in two sizes: 6"x8" and 6"x32". It provides work speeds from 90 to 575 R.P.M. with all speed changes controlled by variable pitch sheaves. Table speeds from 28" to 188" per min. are available. Infinitely stepless adjustments from minimum to maximum are provided for both work and table speeds.



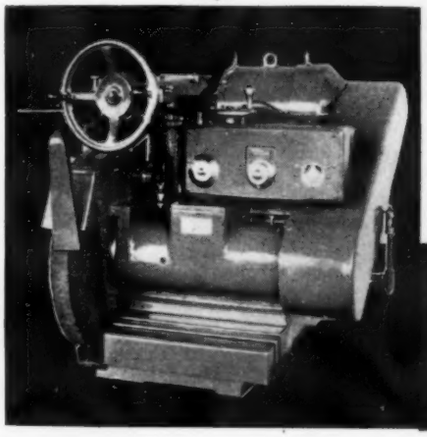
THE FITCHBURG SPLINE GRINDER

With this new Fitchburg machine, both gears and splines can be accurately ground. It is built in 30" and 60" distances between centers with table type turning device and 72" with wheel head mounted type.

Wheel head column may be swivelled to a maximum of 20° for either right or left hand helical lead angle. Headstock can be furnished for either straight, right hand or left hand helical splines or both. A standard 12-Key plate takes care of 12, 8, 6, 4, 3 and 2 spline shafts. Other spline divisions can be taken care of by the use of separate index plates.

THE BOWGAGE HEAD

Application of this self-contained independent grinding wheel head unit provides automatic grinding wheel feed. The BOWGAGE HEAD will modernize old style machines and is adaptable to all grinding machines within its range. The head has rapid traverse, slow grinding feed, grinding dwell or spark out and rapid return to starting position, all started by one push button.



FITCHBURG PLUNGE CUT GRINDERS

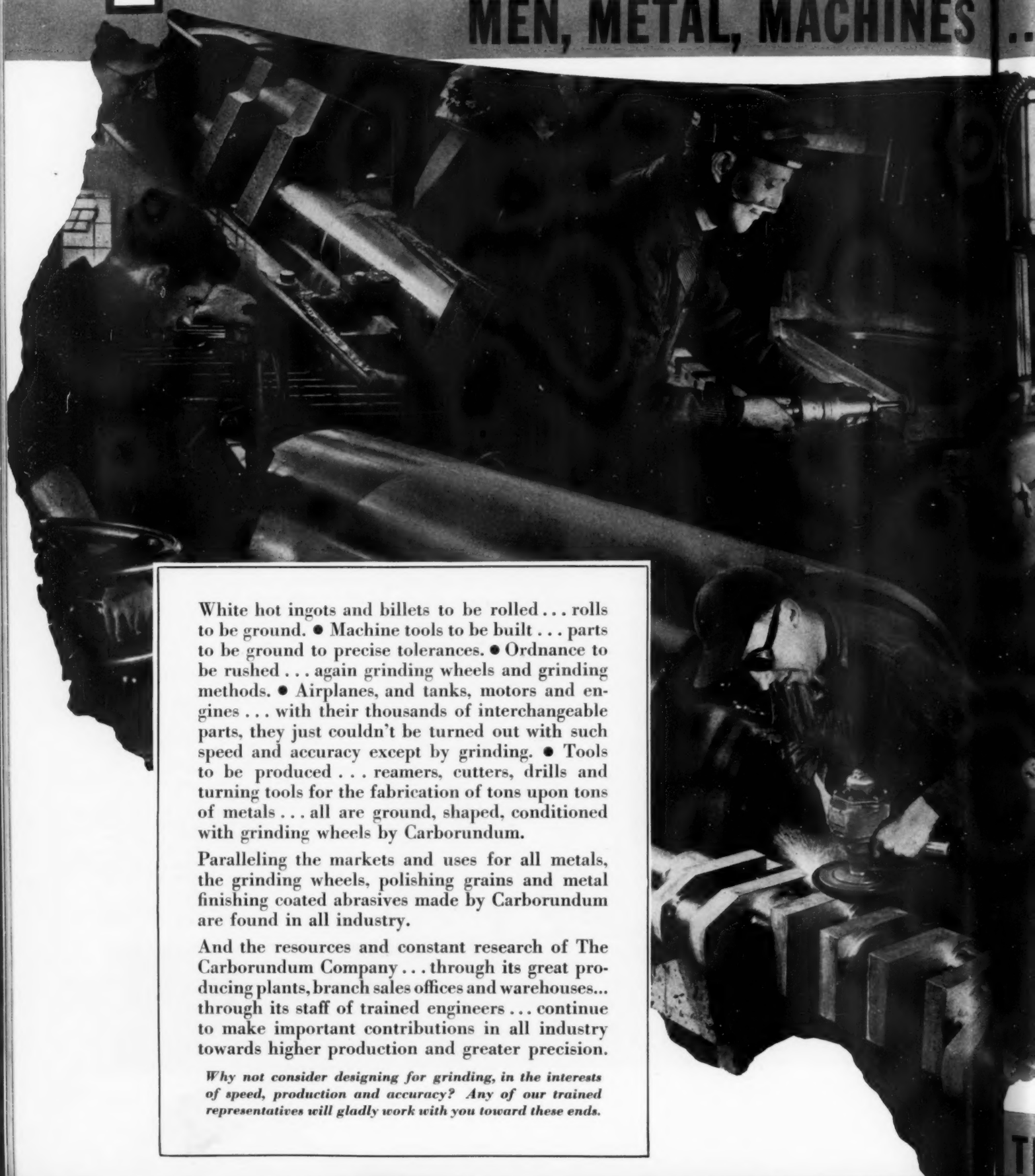
These units are built in both center and chucking grinder types. The center type machine, with a capacity 6"x12" and designed to do plunge grinding only, has no table traverse but is provided with wheel spindle reciprocation. The chucking type has a headstock which can be arranged for cylindrical work only or furnished with a swivel head for taper work. Either type requires a minimum of floor space. Both types are built around Standard Bowgage Wheel Head Units which have a complete automatic dial controlled cycle.

Detailed specifications of all types and sizes of FITCHBURG GRINDERS are available on request.

FITCHBURG GRINDING MACHINE CO.

4 ★★★★ great factors in p

MEN, METAL, MACHINES ..



White hot ingots and billets to be rolled . . . rolls to be ground. • Machine tools to be built . . . parts to be ground to precise tolerances. • Ordnance to be rushed . . . again grinding wheels and grinding methods. • Airplanes, and tanks, motors and engines . . . with their thousands of interchangeable parts, they just couldn't be turned out with such speed and accuracy except by grinding. • Tools to be produced . . . reamers, cutters, drills and turning tools for the fabrication of tons upon tons of metals . . . all are ground, shaped, conditioned with grinding wheels by Carborundum.

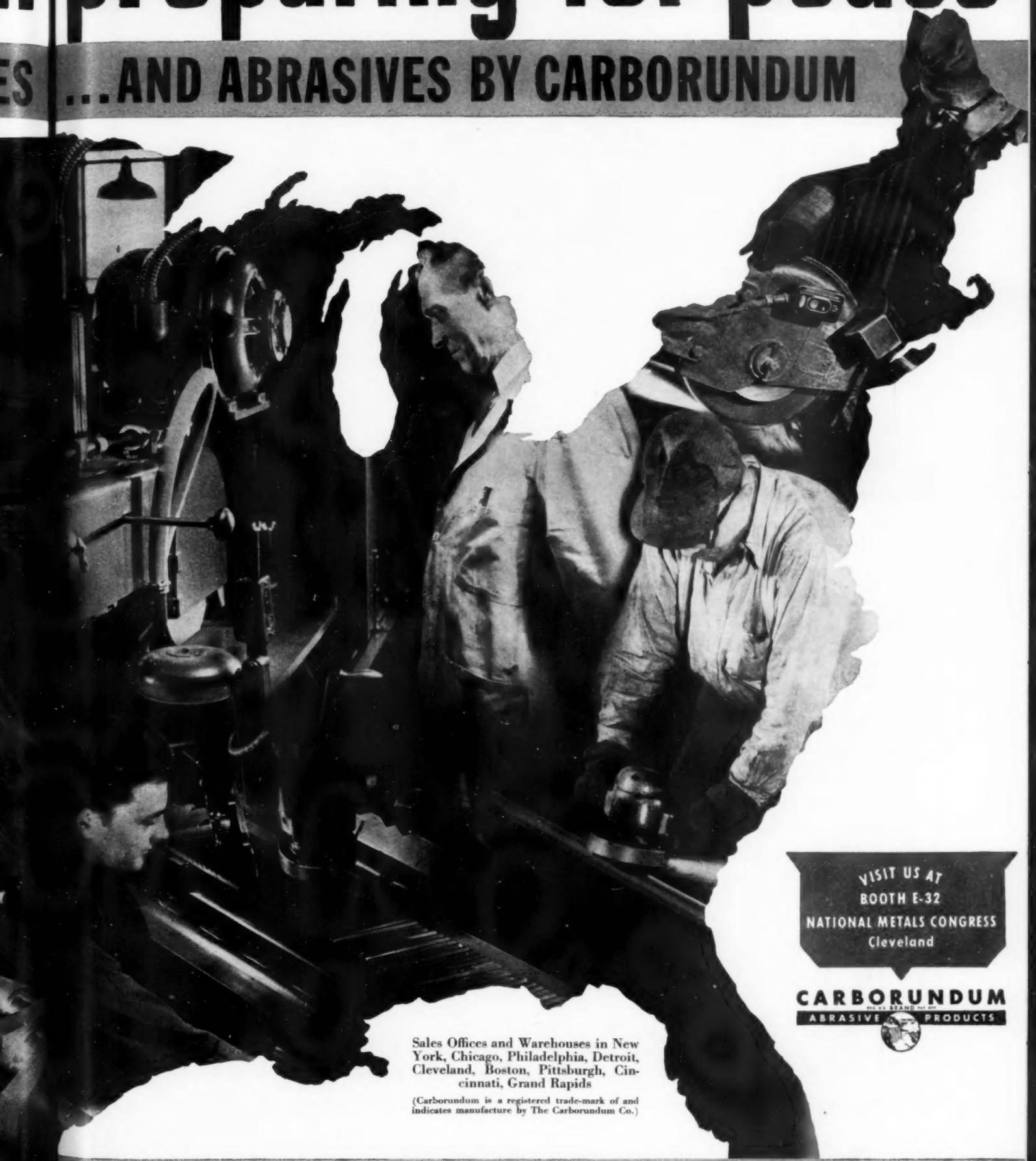
Paralleling the markets and uses for all metals, the grinding wheels, polishing grains and metal finishing coated abrasives made by Carborundum are found in all industry.

And the resources and constant research of The Carborundum Company . . . through its great producing plants, branch sales offices and warehouses... through its staff of trained engineers . . . continue to make important contributions in all industry towards higher production and greater precision.

Why not consider designing for grinding, in the interests of speed, production and accuracy? Any of our trained representatives will gladly work with you toward these ends.

preparing for peace

...AND ABRASIVES BY CARBORUNDUM



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BOOTH E-32
NATIONAL METALS CONGRESS
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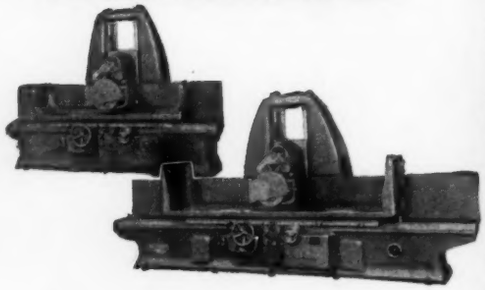
REG. U.S. PAT. OFF. BRAND
ABRASIVE PRODUCTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Co.)

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

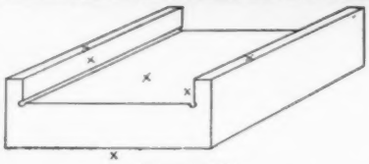
MATTISON
HIGH-POWERED
PRECISION SURFACE GRINDER



MATTISON GRINDER

Cuts Time 75%

When added together, time savings like this not only make a big difference in manufacturing cost but help speed up delivery schedules. To show what Mattison Grinders can do on your work, send us blue prints for production estimates.



Ground at X

Machine: . . Mattison 24" x 96" Surface Grinder
Work: . . . . . Cast iron frame, high steel content
Stock Removal: . . . . . Approximately .020
Previous Method: . . . . . Hand scraped
Present Method: . . . Now ground. Top and bottom of casting—shoulder and inside surface. At 75% time saving.

MATTISON MACHINE WORKS—ROCKFORD, ILLINOIS

VITRIFIED

Keep production on its toes by standardizing on . . . VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Vitrified Wheels

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

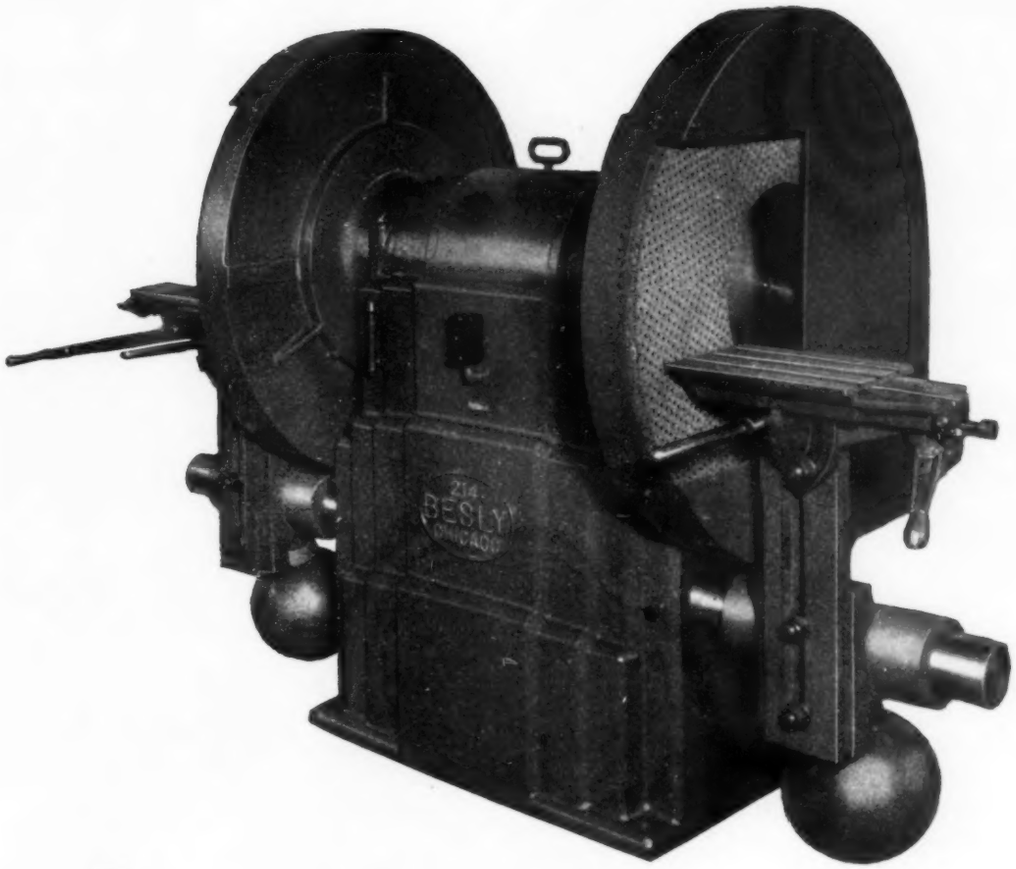
. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

VITRIFIED WHEEL CO.
WESTFIELD MASS.

Keeping pace with improvements in Abrasive Discs



Besly Titan Steelbac Abrasive Discs (Resinoid Bonded) with 1″, 2″ and 3″ of useable abrasive were introduced by us and have been adopted by most progressive manufacturers. ● Our next step was to bring out a line of Disc Grinders capable of carrying these improved heavy grinding members. Illustration shows a No. 214 Besly Grinder which is one of a series of machines developed to meet modern conditions. This machine has 40″ grinding members with oversize Geared Lever Feed Tables. The Rockershafts are larger than heretofore. The Wheel Collars backing up the Steel Disc Wheels are 22″ diameter. The spindle is almost 4″ diameter in the bearings. Heavy Welded Steel Hoods protect operator, while the sturdy, well proportioned base helps absorb the vibration always present in a grinding machine.

This type of Besly Grinder is built in various sizes to carry 15″ to 40″ diameter grinding members, all with Multiple Vee Belt Drive employing standard motor mounted at rear of base. If you are thinking of replacing your old Disc Grinder, be sure and get details concerning these newly designed Besly Grinders.

Write for your copy of Booklet on Besly Titan Steelbacs.

CHARLES H. BESLY AND COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

For Today's Tough Jobs

IN normal production . . . or for those important defense jobs . . . the design of Kent-Owens Milling Machines gets the approval of practical shop men everywhere. These machines meet today's demands for greater production and dependability. For advanced features including rigid, compact design . . . simple, dependable hydraulic feed . . . wide spindle speed range with *only two* gear contacts . . . and many other important advantages call on Kent-Owens! Write for bulletins or submit data for a production estimate. Kent-Owens Machine Company, Toledo, Ohio.

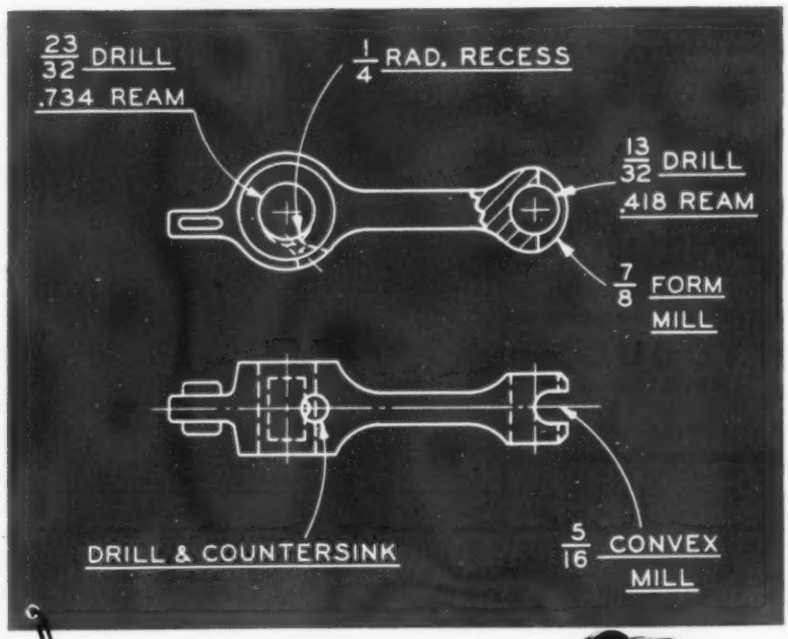
KENT OWENS TOLEDO OHIO

Call on KENT-OWENS for Milling Machines

For Production **plus** Accuracy

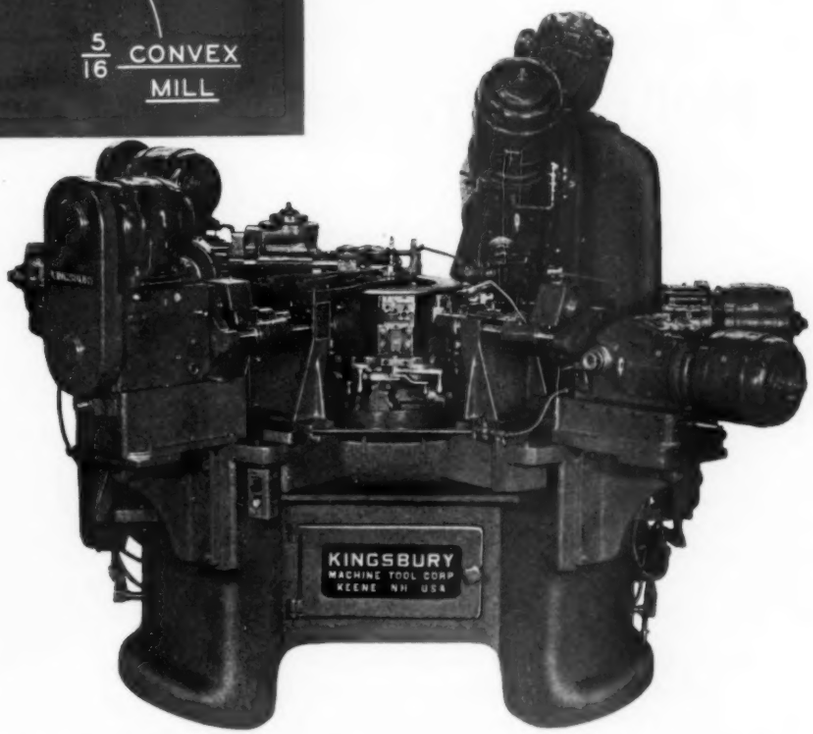
FLEXIMATIC

by KINGSBURY



FLEXIMATIC jobs speak for themselves in production savings and increased accuracy. Note the number of different types of operations required on the refrigerator unit connecting rod shown. If separate, general purpose machines were employed for this work, the time, labor and equipment involved would take out all the profit.

The Model GH FLEXIMATIC illustrated —made up of standard Units mounted on a standard base—performs every one of these operations in automatic cycle. In the time it takes to load and unload, all nine operations are complete!



The FLEXIMATIC consists of standard Units mounted on one of several standard bases. This unique method provides a flexible set-up readily changed over to meet the machining requirements of many different parts.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

Announcing the NEW "VARIMATIC" SUPER-SENSITIVE DRILLING MACHINE

. . . setting new standards in speed range, sensitivity, easy operation and all-round performance

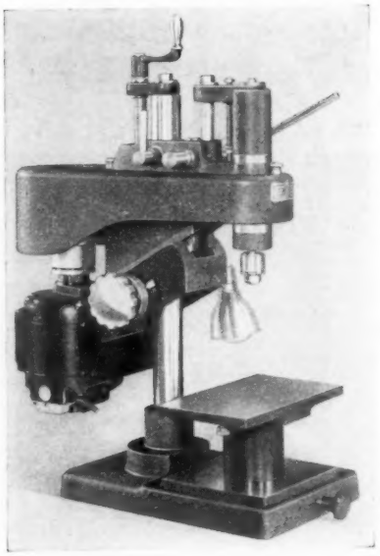
In this new machine, Hamilton-Muehlmatt offers a tool of "instrument precision"—one that can be depended on with utmost confidence for the finest kind of tool room and manufacturing work.

Speed adjustment is infinitely variable in two speed ranges—from 840 to 2700 RPM and from 2900 to 9300 RPM. Any speed in each range is obtainable immediately by manipulation of hand wheel; change from one range to the other is accomplished by merely slipping belt from one step of drive and spindle pulley to another. A graduated speed dial shows the spindle speed.

Drill unit is self-contained, swings radially and can be locked in any position. Drilling capacity .004" to $\frac{5}{16}$" in all drillable materials.

OTHER OUTSTANDING DETAILS

All controls manually operated; drilling unit adjustable 6½" vertically by elevating screw; base 15½" x 10"; overhang of drilling unit from center of chuck to column, 5"; floating type feed mechanism controlled by adjustable counter balance; motor ¼ H.P.; motor speed 1725 RPM; motor characteristics to suit current available.



THE HAMILTON TOOL CO.

230 BEE STREET **HAMILTON, OHIO**

Write for complete detailed specifications of the Hamilton-Muehlmatt Maxi-Varimatic Super Sensitive Drilling Machine.

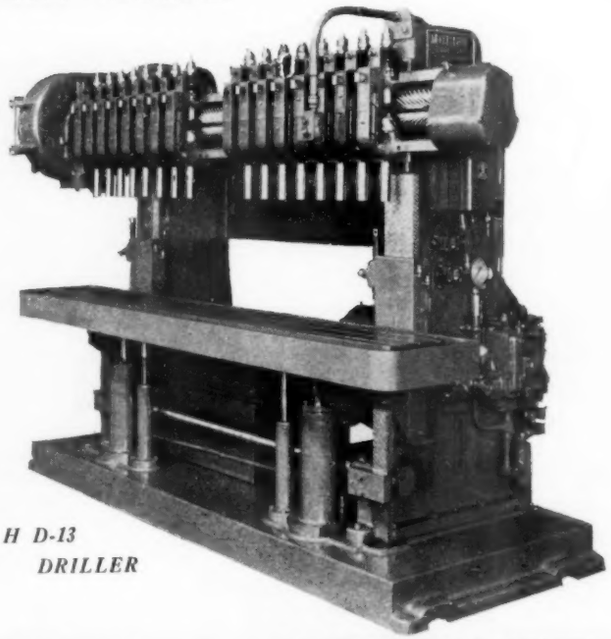
Multiple Drilling Saves Time

Whether you want to drill . . .

PLATES • STRIPS • CHANNELS
ANGLES • PIPES • CASTINGS

there is a Moline straight line driller to make the job easier and faster. The No. HD-13 Straight Line Driller has the following combination of features:

1. Equalized, hydraulic, table feed.
2. Automatic, electrically controlled feed cycle.
3. Spindle spacing can be changed easily.
4. Spindles can be added or removed with a minimum of delay.
5. R.P.M. of spindles can be varied to suit requirements.
6. Exact spot facing depths can be provided, if required.
7. Can be furnished in 6, 8 and 10-ft. length.
8. Approximate capacity—Twelve ¾" or Sixteen ½" drills in steel.



H D-13 DRILLER

BORING • HONING • DRILLING • SPECIAL MACHINERY

MOLINE TOOL COMPANY **MOLINE, ILLINOIS**
Cable Address "Holehog" Moline

ESTABLISHED 1901

FREE INFORMATION FOR YOUR METAL-WORKING LIBRARY

Latest Catalogs, Booklets and Bulletins

METAL-WORKING EQUIPMENT

1 SURFACE GRINDERS—Reid Bros. Co., Inc., Beverly, Mass., 12 page catalog on line of surface grinders, well illustrated and with diagrams showing the working of the machines. Complete descriptions with specifications.

2 MILLING MACHINES—Fray Machine Tool Co., Glendale, Cal. Two-color 8-page folder illustrating and describing their milling machines. Various milling attachments are shown and explained.

3 SURFACE GRINDERS — Blanchard Machine Co., Cambridge, Mass. 24-page well illustrated Catalog 18 describes grinders and attachments. Various operations are shown with typical cases.

4 LATHES—Gisholt Machine Co., Madison, Wis. Performance data sheets No. 58–61. Each sheet has valuable data on actual case studies of metal-turning and balancing methods. Operations for each step described in detail with performance figures.

5 FORGING HAMMERS. Erie Foundry Co., Erie, Pa. Bulletin 335, 15 pages with illustrations, diagrams, and specifications of their line of single frame forging hammers. Action pictures and instructions for installation and operation.

6 PIPE TOOLS—Beaver Pipe Tools, Inc., Warren, Ohio. 8-page folder on line of pipe and bolt machines. Recommendations from other users quoted.

7 BROACHING PRESSES — Colonial Broach Co., Detroit, Mich. 2-page, two-color folder on Colonial's new line of "Senior" presses of 1 to 10-ton capacity has specifications, illustrations and operating advantages.

TOOLS AND ACCESSORIES

8 MILLING CUTTERS—Severance Tool and Mfg. Co., Saginaw, Mich. Bulletin 12-E describes Severance "Chatterless" countersinks both the standard and heavy duty types. Specifications and prices given.

9 PRODUCTION TOOLS—Wesson Co., Detroit, Mich. 53-page catalog on high production steel, cemented carbide and other hard alloy cutting tools. Tools illustrated with sizes and prices for each type. Diagrams used for clarity.

10 SOCKET WRENCHES — Owatonna Tool Co., Owatonna, Mich. 6-page folder on heavy duty socket sets and box wrenches with descriptions and prices.

11 ELECTROPLATING INSTRUMENTS—Foxboro Co., Foxboro, Mass. Folder on Foxboro Duplex Controller and Long-Distance Dial Pipe Pipe Thermometer for obtaining uniformity in electroplating. Specifications and advantages of these instruments are given.

12 SOLDER POT—Electric Soldering Iron Co., Inc., Deep River, Conn. Catalog Sheet 511 illustrates new line of Esico solder pots. Pilot light indicates failure in operation immediately.

13 FILES—American Swiss File & Tool Co., Elizabeth, N. J. 12-page folder illustrates their versatile line of files, giving sizes that various shapes can be obtained in. Advantages of files described.

HEAT-TREATING AND WELDING

14 WELDING—Una Welding, Inc., Cleveland, Ohio. 16-page catalog on Unamatic Process which makes it possible possible to duplicate manual welding with automatic welding where there is some continuity of process or production. Large illustrations and descriptions of parts, accessories and methods of operation.

15 CARBORIZING CONTAINERS — Michigan Steel Casting Co., Detroit, Mich. Folder featuring Inconel containers for heat treating. Describes advantages and shows containers after long use.

For Your Convenience

Two business-reply cards are printed here. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for five to eight pieces, use both cards.

2. Be sure to fill one space for each piece you order. This will assure your receiving copies of literature promptly by reducing clerical work in handling your requests.

3. When you have filled out one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail. No postage is required.

Example

Write in circle number of item describing one catalog wanted → (23)

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Address 1243 E. 7th St.

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Company W.C. Dow Mfg. Co. Title Engineer.

AMERICAN MACHINIST, New York.

These cards not good after Dec. 1, 1940

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Write in circle number of item describing one catalog wanted →

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Address

Company Title

AMERICAN MACHINIST, New York. 10-16

16 FURNACES—Bellis Heat Treating Co., Branford, Conn. Several pages on their line of Bellis Lavite Furnaces describing operations and outstanding features. Also sheet on Bellis Lavite heating medium describing types and applications.

PLANT SERVICE EQUIPMENT

17 STEEL GRATING—Blaw-Knox Co., Pittsburgh, Pa. 3-color well illustrated Catalog 1773 on electroforged steel grating and stair treads describes method of manufacturing. Lists wide range of uses, safe loads and size variations.

18 LIGHTING — Hygrade Sylvania Corp., Miralume Division, Ipswich, Mass. 22-page catalog on Miralume fluorescent lighting with illustrations of types and specifications giving comparative lighting figures.

19 HOISTS—Coffing Hoist Co., Danville, Ill. Catalog G-3 describes line of hoists illustrating types, giving specifications and load capacities. Operation photos and outstanding features illustrated.

20 LUBRICATION — Lubriplate Division, Fiske Bros. Refining Co., Newark, N. J. 8-page folder illustrating Lubriplate applications and advantages. Two pages of users' opinions.

21 INDUSTRIAL DERMATITIS—Milburn Co., Detroit, Mich. 44-page booklet describes causes and prevention of industrial skin diseases. Proper creams and ointments for specific applications discussed. Underlying principles of skin injury in relation to industrial dermatitis described.

22 PROTECTIVE LIGHTING — Holophane Co., Inc., New York. Engineering data on proper methods and lighting for industrial plants with diagrams and charts showing best method for given applications.

23 FREIGHT ELEVATORS—The Warner Elevator Mfg. Co., Cincinnati, Ohio. 8-page folder "What You Want to Know About Freight Elevators." Pictures and diagrams show construction of elevators and discuss applications for jobs shown.

24 MOTOR CONTROLS — Trumbull Electric Mfg. Co., Plainville, Conn. 51 page catalog on line of electrical control apparatus including Multi-Breaker Power Panels and new line of Motor Control Centers. Specifications and prices given.

25 INDUSTRIAL DERMATITIS—Magnus Chemical Co., Inc., Garwood, N. J. 4-page folder on Magnus Skingard. Cleaning action is described and illustrations show advantages of using this safeguard.

26 LIGHTING—Westinghouse Electric & Mfg. Co., Cleveland, O. Six 4-page folders illustrating advantages, uses, installations and operations of fluorescent lighting. Controls and ballast units are diagrammed.

CLEANING AND FINISHING

27 FINISHING — Globe Machine & Stamping Co., Cleveland, Ohio. 12-page folder on line of finishing and tumbling barrels with diagrams and illustrations showing applications and individual parts.

PARTS AND MATERIALS

28 ROLLER CHAIN—Morse Chain Co., Ithaca, N. Y. 92-page bulletin R-40. Complete information on construction of channel-lubricated, interchangeable roller chain. Selection of right chain, performance data, engineering information and price list for chains and sprockets.

29 STEEL—Joseph T. Ryerson & Son, Inc., Jersey City, N. J., has produced a 256-page thumb-indexed catalog listing all steels.

30 CARBIDE TOOLS — McKenna Metal Co., Latrobe, Pa. New chart lists horsepower requirements for cutting steel with Kennametal tipped tools. Formula on chart enables calculation of horsepower for any steel of which tensile strength, feed and speed of cut is known.

31 MOTORS—Bodine Electric Co., Chicago, Ill. 4-page folder shows unusual applications of Bodine synchronous motors. Engineering data on the lubrication of worm gears included.

32 CAPACITORS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 24-page booklet on selection and application data on capacitors. Construction and operating features explained. Photographs illustrate points brought out in text.

33 COOLANT PUMPS—Warren Steam Pump Co., Inc., Warren, Mass. 4-page bulletin describing "Coolflo" pumps designed especially for the machine tool trade. Both submerged and outside mounted type featured with photographs, outline dimensions, sectional elevation, performance curves and detailed specifications.

34 BUSHINGS——Orange Roller Bearing Co., Inc., Orange, N. J. 20 pages of engineering data on bushings. Complete information on dimensions, oil holes and capacities.

35 ELECTRONIC DEVICES—General Electric Co., Schenectady, N. Y. 20-page booklet GES-2411 lists more important vacuum-tube apparatus and describes application and method of operation. Uses in automatic arc-welding equipment and resistance welding equipment illustrated.

36 ELECTRICAL CONTACTS—Gibson Electric Co., Pittsburgh, Pa. Catalog C-10 describes eight standard Gibsiloy contact materials. Photographs illustrate contacts and contact assemblies. Technical data on resistance-pressure relations, endurance characteristics and temperature rise characteristics.

37 RECTIFIERS—Fansteel Matallurgical Corp., North Chicago, Ill. Bulletin FL-3 illustrates, describes and diagrams their line of rectifiers.

38 GASKETS—Goetze Gasket & Packing Co., Inc., New Brunswick, N. J. 64-page Catalog 53 on industrial gaskets contains engineering data and shows many new and improved products with size and price information.

39 STEEL—Egleston Bros. & Co., Inc., Long Island City, New York. 80-page thumb-indexed Catalog 2 lists their line of angles, beams, channels, bars, plates and sheets for immediate delivery.

40 TRANSMISSION BELTS — Hewitt Rubber Corp., Buffalo, N. Y. 4-page folder on transmission belts giving prices, horsepower per inch of width, belt speeds, arc of contact, etc.

41 DIE STEEL—Jessop Steel Co., Washington, Pa. Folder on Windsor Special air hardening die steel with approximate analysis, hardening and tempering range, thermal expansion, specific heat, etc.

42 ELECTRICAL CIRCUIT EQUIPMENT—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 64-page "Quick Selector" catalog on correct electrical equipment for any motor, lighting or feeder circuit. Four pages of application data on recommended installation practices, with tips on mounting and connecting apparatus.

43 BRONZE—The Phosphor Bronze Smelting Co., Philadelphia, Pa. 8-page booklet on line of Phosphor Bronze giving specifications and engineering data on rods, sheets and strips, spring wire, welding wire, etc.

44 MOTORS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 26-page catalog B6033 describes synchronous motors and their construction. Typical installations shown in large photographs.

45 V-BELTS—Pyott Foundry & Machine Co., Chicago, Ill. 112-page handbook on V-belt drives, making use of revised V-belt ratings. "Economy tables" enable users to select cheapest drive. Illustrates interesting drive installations with prices and engineering data.

46 SPEED INCREASERS — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. 24-page illustrated booklet, No. 3650, describes complete line of Type SU speed increasers. Application data, construction features and complete specifications. Flow diagrams explain the lubrication system.

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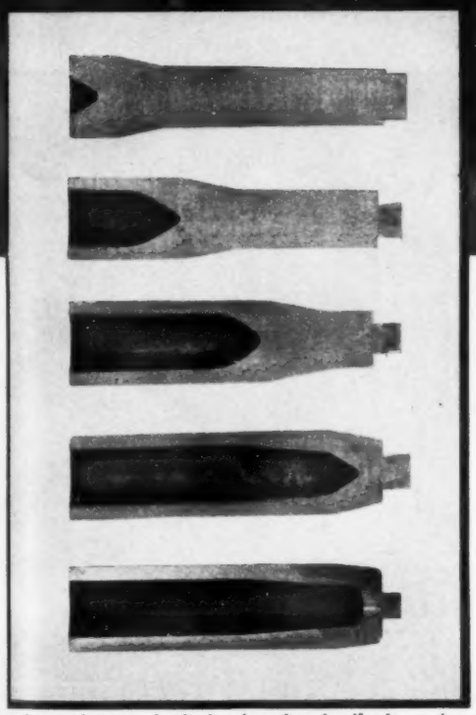
Latest Practice –

IN FORGING SHELLS ON AN ACME "XN" 5-INCH FORGING MACHINE



• *Successive steps in the forging of projectiles in an Acme XN forging machine.*

• Here is one of the 5-inch ACME XN forging machines at work forging projectiles for our own preparedness program. Forging practice has advanced during recent years to the point that so great a degree of accuracy can be maintained in steady production that it is no longer necessary to machine the internal surfaces of the shell. Specified tolerances on shell bores, minus nothing, plus .020", are easily maintained.

This ACME XN forging machine will produce 75-mm. shells at the rate of 75 an hour. It will forge 105-mm. shells with change of dies. This powerful machine's frame, a one-piece steel casting, accounts for over 100,000 lbs. of the total weight of 190,000 lbs. Five cavity dies are used to forge the shells. Pilot holes in plate at front of fixed die serve to insure a true center for punches and also act as a stripper.

This machine is now equipped with a manipulator, (*patents applied for*) developed by Acme engineers to sustain entire weight of the forging, thereby eliminating fatigue of the operator. It transfers and locates stock mechanically in each groove of the dies progressively, thereby increasing production 10% to 15%.

All ACME XN forging machines have the eccentric type main shaft, fully suspended header slide and suspended die slide, with double toggles. A catalog fully describing them will be sent on request.

ACME MACHINERY DIVISION

of THE HILL ACME COMPANY

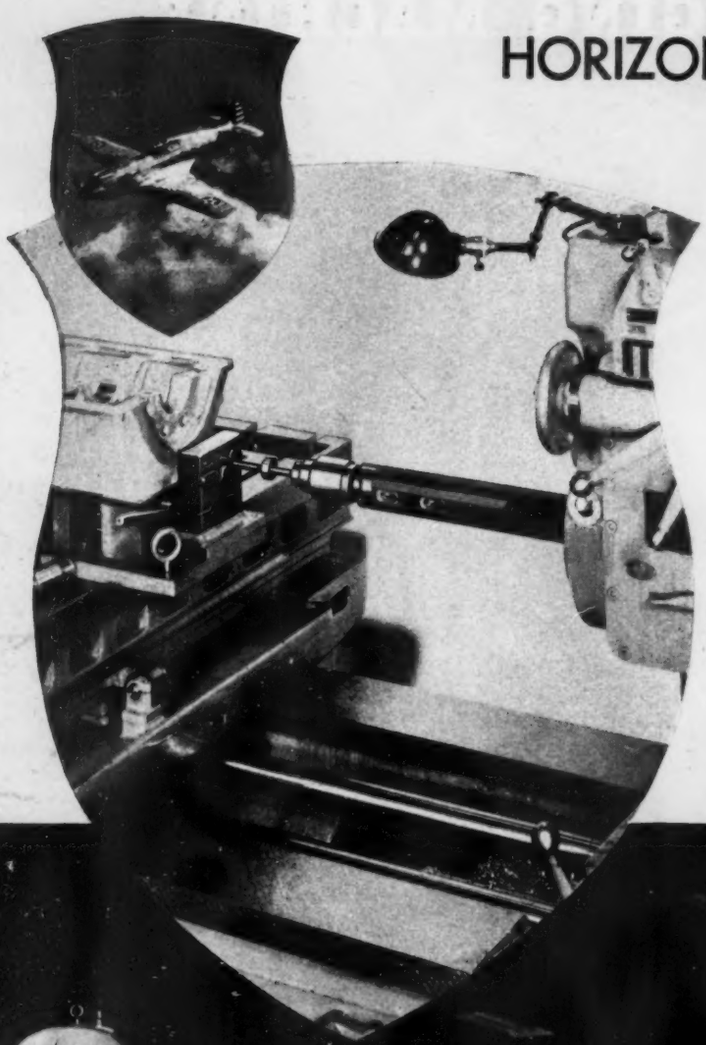
Established 1862

FORGING • THREADING • TAPPING • BOLT • NUT • RIVET MACHINES

4535 ST. CLAIR AVENUE

Cleveland, Ohio

GIDDINGS & LEWIS



HORIZONTAL BORING, DRILLING

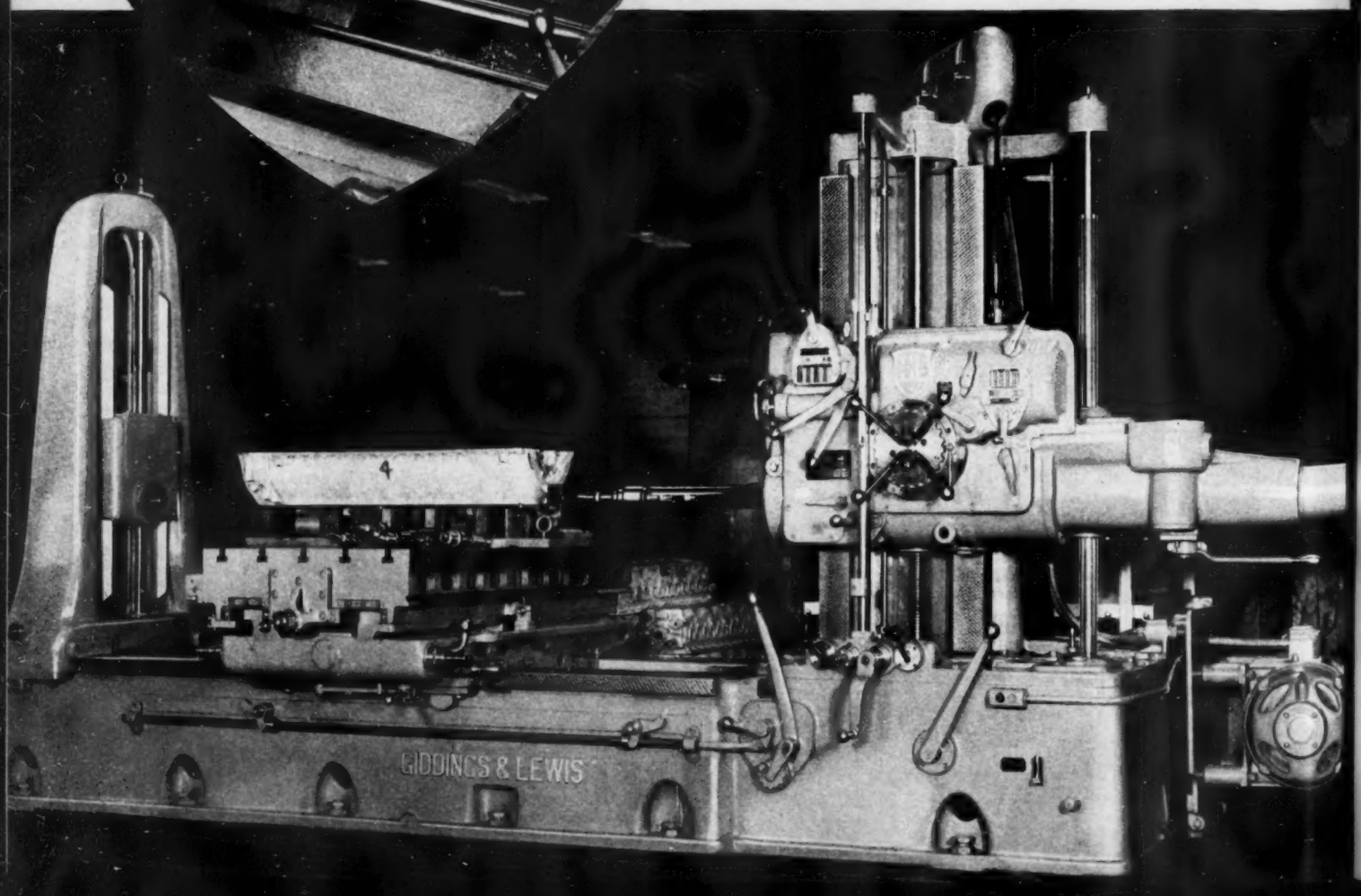
. . and . .

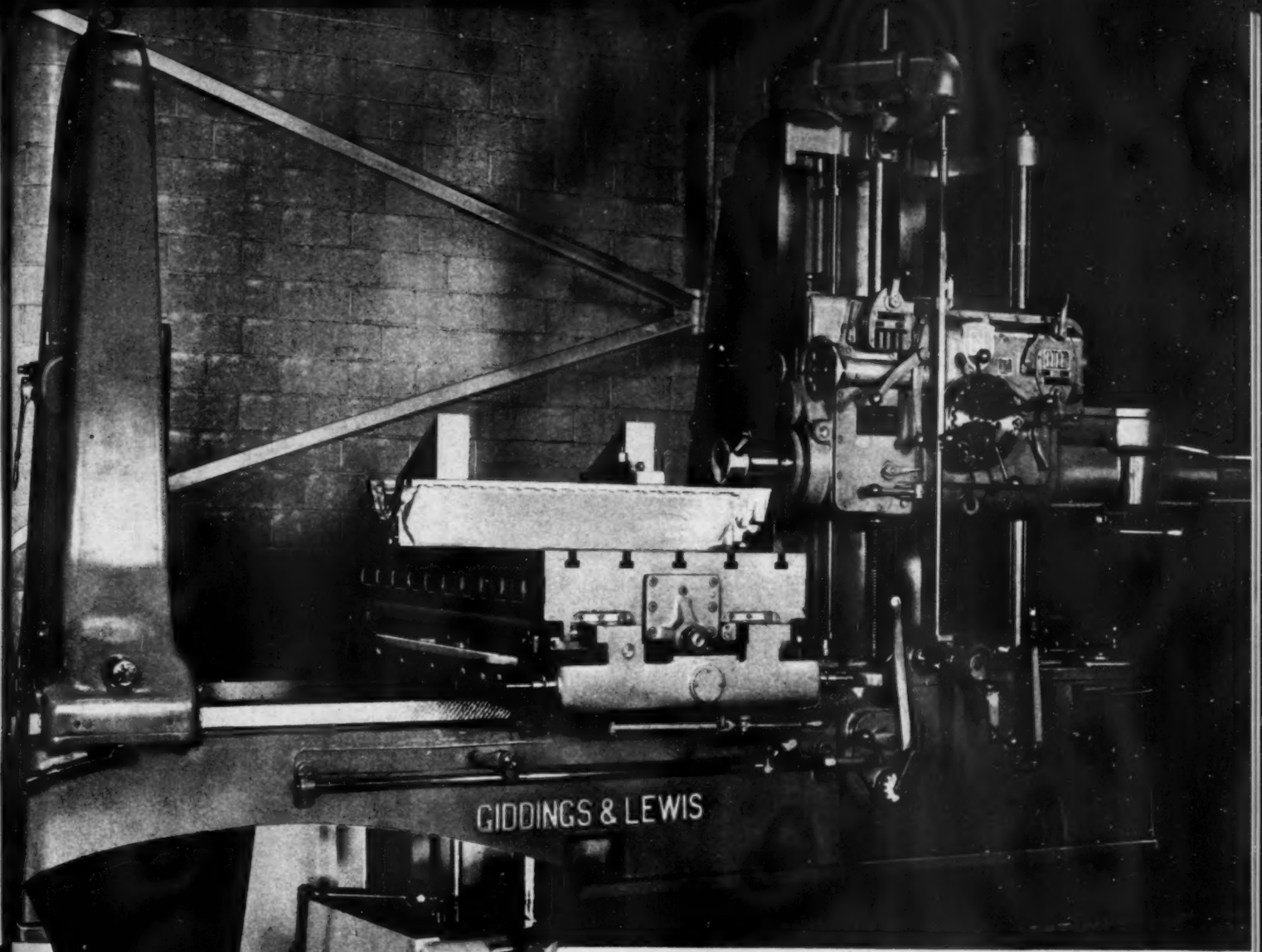
MILLING MACHINES

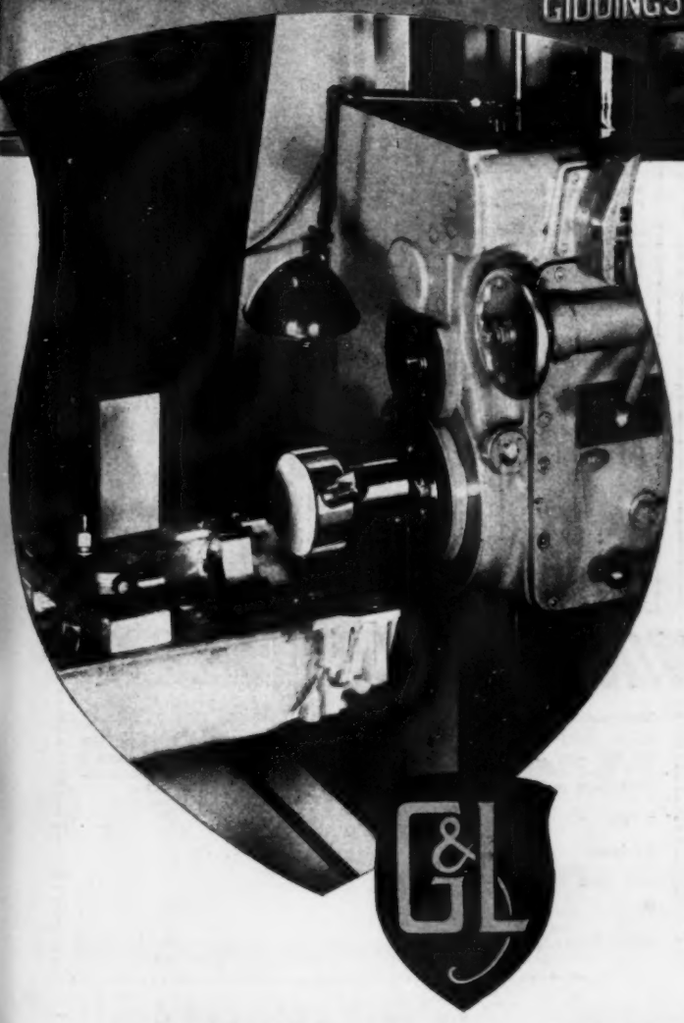
FOR HIGH-POWER
PRECISION OUTPUT

. . of . .

AIRCRAFT ENGINE PARTS







The Allison Engineering Company applies these Giddings & Lewis Horizontal Boring, Drilling and Milling Machines to the high speed, high precision output of accurate parts for Allison Aircraft Engines. The photographs at the left show the set-up and an operation close-up on the drive shaft bearing in an upper crankcase. The photographs above show another G & L Machine set-up for boring operations on a gear bearing in a lower crankcase. The versatility of these G & L Machines, their rigidity and their ability to produce high power, high precision boring, drilling and milling jobs with great economy make them ideal not only for Aircraft parts, but for all fine manufacturing needs. A list of features and special advantages, together with specifications, will be sent upon request. Engineering recommendations gladly furnished upon receipt of manufacturing data.

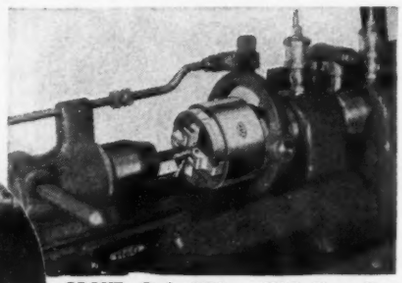
GIDDINGS & LEWIS MACHINE TOOL CO.

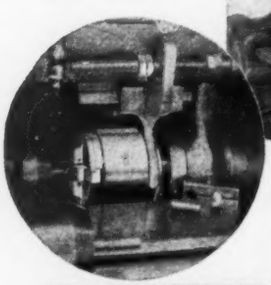
FOND DU LAC, WISCONSIN, U. S. A.

More threading– less down time with

H&G

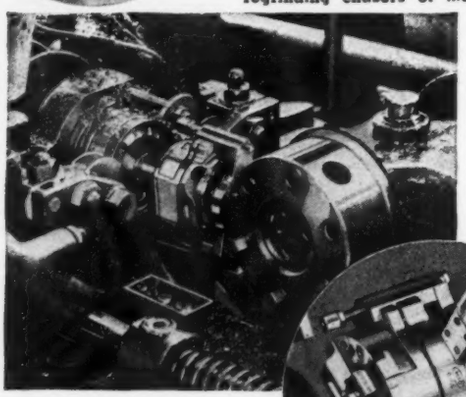
INSERT CHASER
DIE HEADS

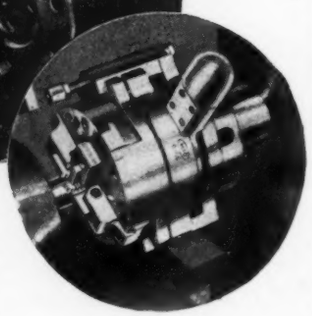




ABOVE—Style MM on H&G Threading Machine. Ideal for any threader as chasers can be changed by inexperienced operators without adjustments.

LEFT—Style MM Rotary on Gridley Automatic. High net production because there's no appreciable down time lost regrinding chasers or making adjustments.





ABOVE—Style DM on Brown & Sharpe Automatic. Production, 1,000 pieces per hour.

RIGHT—Style DMS for Turret Lathes. Note provision for front end trip. Ideal for threading to a shoulder.

STANDARDIZATION

Insert Chasers facilitate standardization in all departments where threading is done. Not only do all styles of these heads of a given size use the same chasers, but there are THREE different popular SIZES that actually use the SAME chasers. This advantage gives a flexibility of stock, and the low chaser cost minimizes the money needed for inventory.

In changing to Insert Chaser Die Heads you release 6 to 8 dollars out of 10 for the purchase of new heads . . . a way to work out a standardization program without increasing your investment.

SIZES AND STYLES

A comprehensive range of styles and sizes is available for all machines used for threading.

NEW BULLETIN

Write for a copy of new H & G Bulletin telling details of these tools for better and more economical threading.

THE EASTERN MACHINE SCREW CORP.
20-40 BARCLAY ST., NEW HAVEN, CONN.

THE COMPANY WE KEEP

We find ourselves in the company of manufacturers who are advertising their products to the metal-working trades.

Although we do not manufacture machines, tools or products generally used in the metal trades, we do produce a book that has been a stand-by in the trade for some 21 years.

It is Colvin and Stanley's AMERICAN MACHINISTS' HANDBOOK.

First published in 1909, it has gone through seven editions and fifty printings for a total of 310,000 copies.

The recently revised 7th edition has already been through three printings.

The purpose of this message is not only to sell copies to the individuals who read this advertisement, but to sell them the idea of recommending that the Handbook be placed into the hands of every man who is charged with the responsibility of doing a good job in his shop.

28
helpful sections

Screw Threads
Pipe and Pipe Threads
Drilling
Reamers and Reaming
Taps and Tapping
Files and Work Benches
Babbitting, Brazing, Soldering and Welding
Gearing
Turning and Boring
Milling Machine Feeds and Speeds
Grinding, Honing and Lapping
Screw Machine Tools, Speeds
Punch Press Tools
Broaches and Broaching
Bolts, Nuts and Screws
Measuring and Fitting
Tapers and Dovetails
Shop and Drawing Room Standards
Wire Gages and Stock Weights
Horse-power, Belts and Shafting
Metals and Other Materials
Machine Forgings
Knots and Slings
General Reference Tables
Automotive Data
Railroad Shop Data
Shop Trigonometry
Dictionary of Shop Terms

The book has 1350 pages with over 2500 illustrations and tables and is designed for the daily use of apprentices, draftsmen, toolmakers, tool designers and machinists.

Send for an examination copy and let the book sell itself. Absolutely no obligation, if you are not satisfied.

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42d St., N. Y. C.

Send me Colvin and Stanley's American Machinists' Handbook 7th edition, for 10 days' examination on approval. In 10 days I will send $4.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

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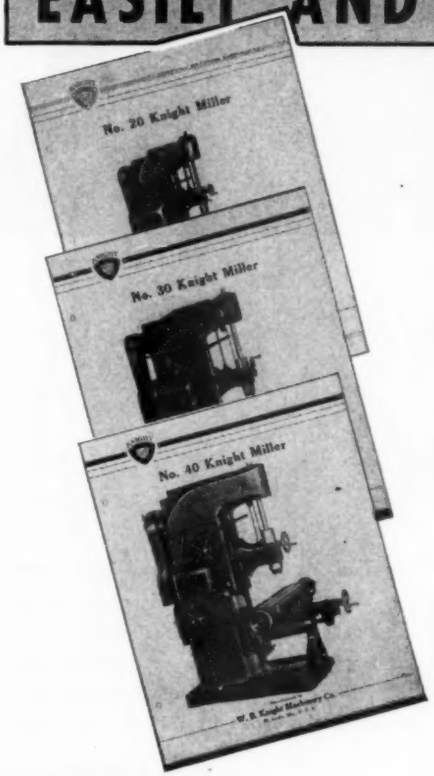
(Books sent on approval in U. S. and Canada only.)

GREATER SPEED IN TURNING OUT HIGHER QUALITY WORK

QUICKLY AND ACCURATELY MACHINE DIFFICULT PARTS *without* SPECIAL EQUIPMENT

TIME SAVINGS BY GETTING ADJUSTMENTS EASILY AND CONVENIENTLY

KNIGHT VERSATILE MILLERS ACCURATE • RIGID •



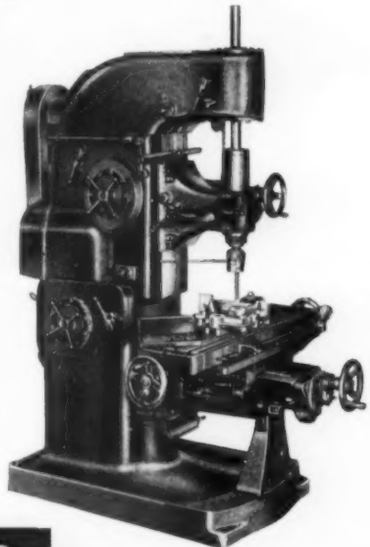
Find out

the many reasons why you get these and many other benefits

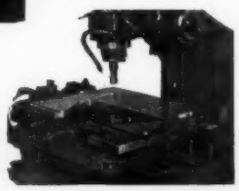
SEND FOR KNIGHT-MILLER BULLETINS

You will find these bulletins interesting—in them you will read about design that is outstanding, about features that work daily to your profit—you'll learn about great accuracy, about ease of operation, you'll get the facts on speed that is particularly of importance now with National Defense production requirements mounting, you'll read why you will be dependably equipped for milling because of the many versatile features for which the Knight Miller is noted, and among other features you'll learn how you can change quickly from one job to another.

Every operation performed on a Knight Miller contributes speed toward getting each job out with time and cost savings. For example, boring operations get accuracy and speed from dial indicators, accurate spindle and square table slides. Timken mounted spindle and accurately fitted rigid table furnish power and accuracy for face milling. There is but a short time required to make setups, particularly the difficult ones. The need for additional setups is practically eliminated, where required they are most simple to make. Read all of the important facts in the Knight Miller bulletins—send for them now.

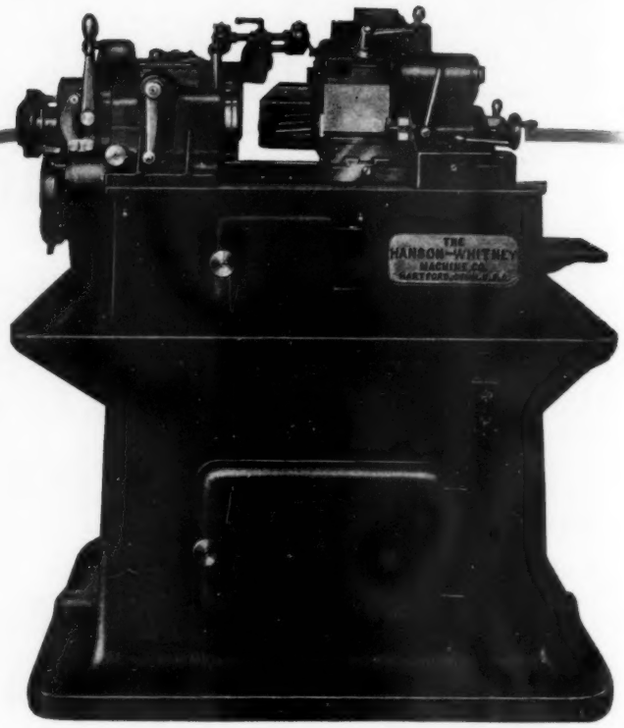


HEAVY MILLING
Power and rigidity permit heavy milling like taking 1/8" off the 5" face of steel forgings by a 2" x 6" helical cutter.



LIGHT MILLING
Ease of operation, quickly changed cutters, quick reading dials provide for efficient light milling operations on this 20" x 25" steel plate.

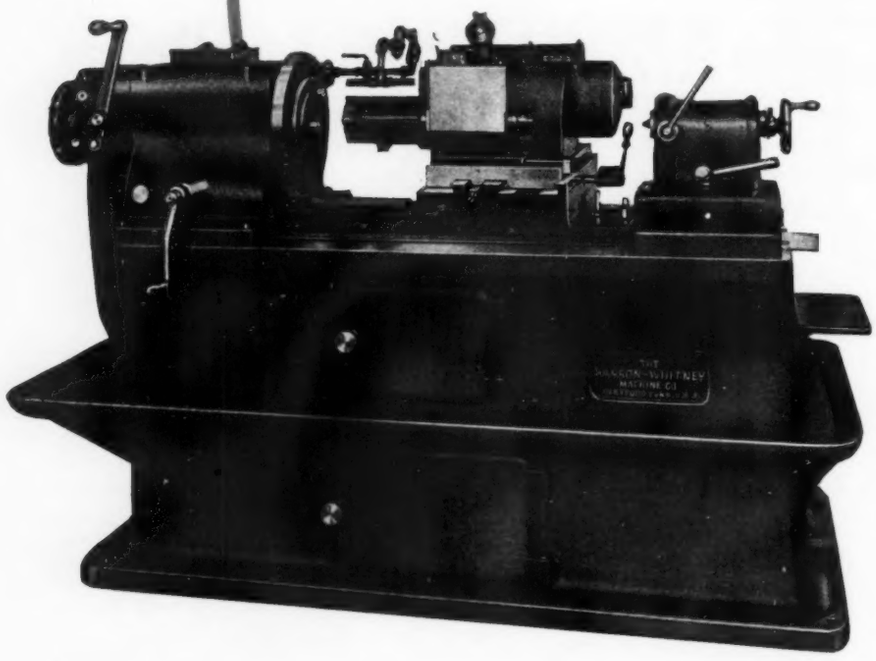
W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •



These modern, fast machines have been developed to insure accurate milling of threads on a truly production basis and to handle difficult work easily, quickly and at low cost. Semi-automatic operation is one of the many features which makes it more profitable to handle production thread milling on an H-W machine.

On these machines, a thread milling hob is used, completing threads in one revolution of the work. Both right and left hand threads may be milled as well as external and internal threads.

The 4 x 9 H-W Universal, Semi-Automatic Thread Milling Machine will handle external work up to 4" diameter and internal threading from ¾" to 4" diameter.



The 10 x 24 H-W Universal Semi-Automatic Thread Miller is similar in operation to the smaller machine but is designed for handling larger work. It has a capacity for external threading up to 10" diameter and will mill internal threads from 1" to 10" diameter.

HANSON-

MORE AND BETTER THREADS WITH H-W THREAD MILLERS

FASTER, MORE ACCURATE TAPPED HOLES WITH "HANSON-PROCESS" TAPS

The reason why "HANSON-PROCESS" TAPS cut keener, more accurately and more economically is the result of a manufacturing process which is under complete control at every step in production. Final finishing after hardening insures perfection and maintained precision. You can see the sharp, clean, cutting edges by examination—you can check accuracy by inspecting for lead, angle and diameter—you can prove the superior tapping quality by putting "Hanson-Process" Taps to work. Try them on tough jobs — note the number and quality of the tapped holes produced between grinds—compare results with the best you've been able to achieve with ordinary taps. Your experience will duplicate that of many other tap users who have proved to their own satisfaction that you can depend on "Hanson-Process" Taps for consistently faster and more accurate tapped holes. You, too, will find it pays to standardize on H-W for all your tapping operations.

WHITNEY

The Hanson-Whitney Machine Co.

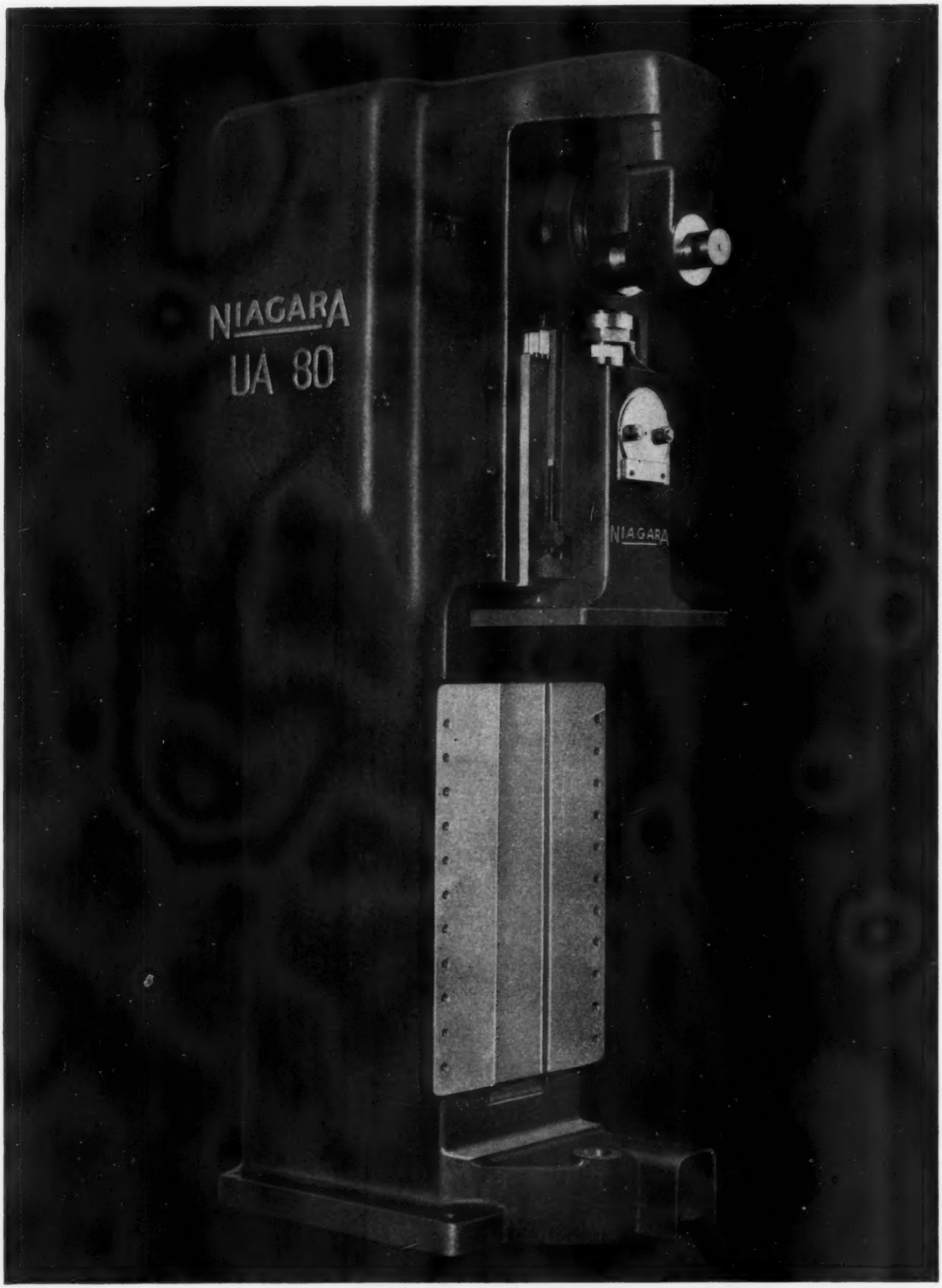
HARTFORD, CONNECTICUT

DOMESTIC REPRESENTATIVES

MACHINERY and SMALL TOOLS—New York, L. C. Biglow & Co., Inc.; Rochester, A. G. Brice; Pittsburgh, William K. Stamets; Detroit, Berry Thomas; Houston, Wessendorff, Nelms & Co.; Los Angeles, A. C. Behringer; St. Louis, Mo., W. H. Scheer.

MACHINERY ONLY—Philadelphia, Lloyd & Arms, Inc.; Cleveland, William K. Stamets; Chicago, Marshall & Huschart Machinery Co.; Dayton, Seifreat-Elstad Machinery Co.; Cincinnati, Seifreat-Elstad Machinery Co.

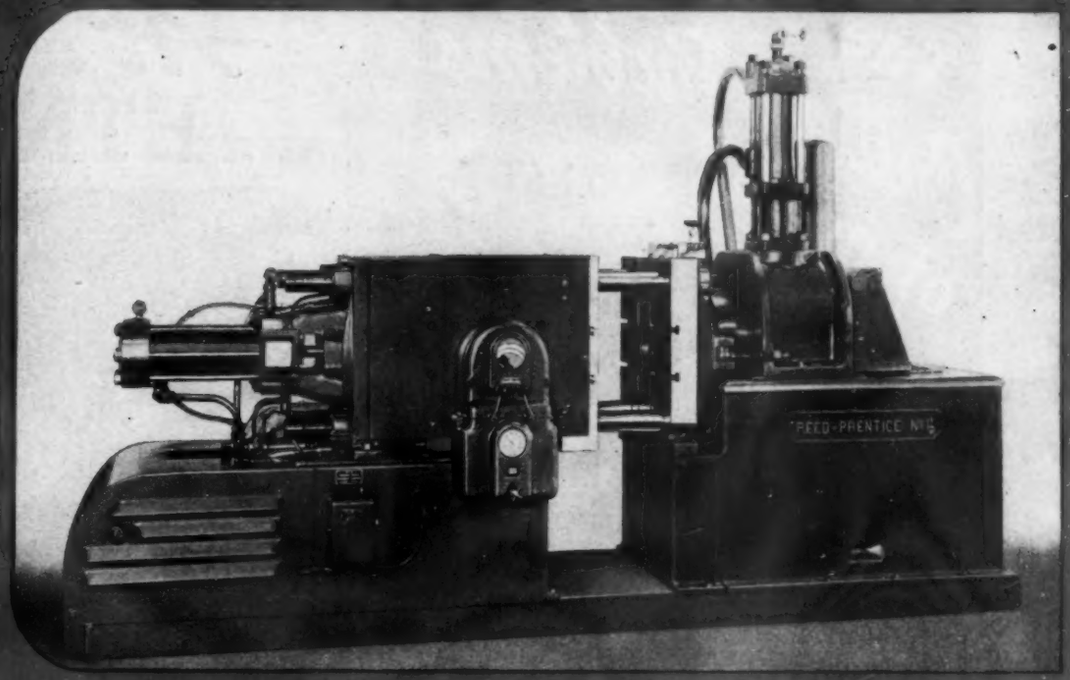
SMALL TOOLS ONLY—Philadelphia, General Tool Sales Co.; Cleveland, George A. Whalen; Chicago, M. Ray Pearce; Minneapolis, E. Willard Pennington; Dayton, George Langen, Jr.; Cincinnati, George Langen, Jr.



An interesting example of functional design resulting in operating economies as well as streamlined appearance is shown in this photograph of one of the Niagara Streamlined Presses.

Frame design provides strength and rigidity as well as a completely enclosed housing for shafts, gearing, fly wheel, motor, 14-point sleeve clutch. All gears are supported between bearings and operate in oil. Write for Bulletin 60-U. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Branches: Cleveland, Detroit, New York.

MODERN REED-PRENTICE DIE-CASTING MACHINES



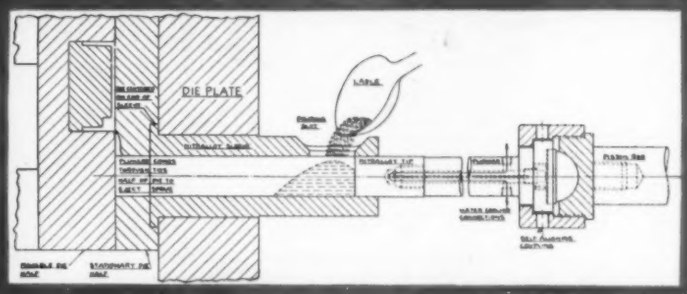
NO. 1-1/2 FULL HYDRAULIC DIE CASTING MACHINE FOR ZINC, TIN OR LEAD BASE ALLOYS WITH SEMI-AUTOMATIC ELECTRIC CONTROL

...chine as shown is arranged for semi-auto-...tic operation. It can also be furnished ...r manual operation. Available in two sizes.
...EATURES:
• Fully hydraulic, with operations controlled ...two levers, when manually operated, which ...re interlocked making it impossible to ...perate the plunger-cylinder until the dies ...re securely locked. • A safety pilot valve ...echanism eliminates the danger of shooting ...e metal when the dies are open. • Dies ...ovide for automatic ejection of castings. ...Die plates are finished on all four sides to ...ovide for core pulling attachments. In ...mi-automatic operation dies are closed ...nually after which cycle is controlled by ...tomatic timing device.

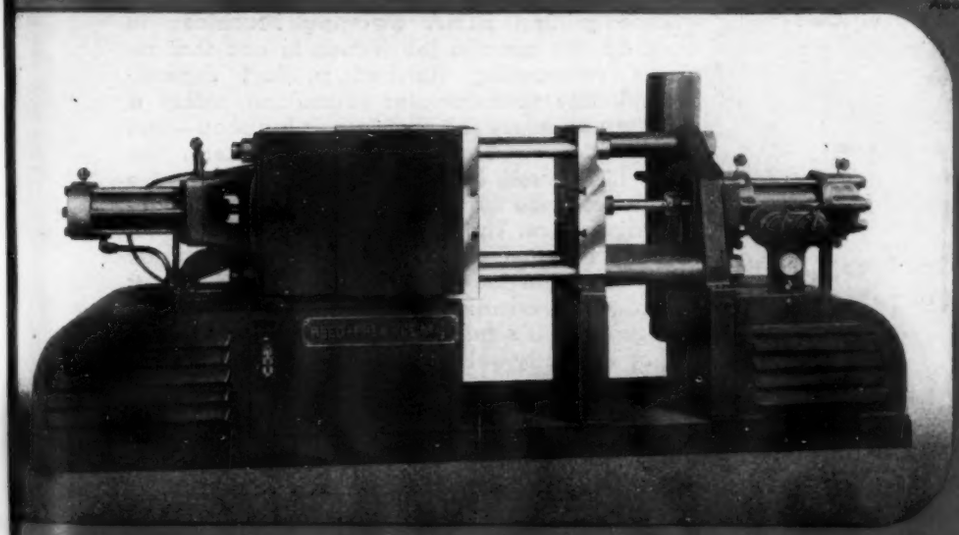
WRITE FOR COMPLETE DETAILS

SPECIFICATIONS

	No. 1½	No. 2
Approximate size of die plates	28x29 in.	32x37 in.
Cap. of melting Pot (Zinc)	700 lbs.	900 lbs.
Space between bars	15x18 in.	18x21 in.
Die Opens	10 in.	12 in.
Maximum Die Space	18 in.	24 in.
Minimum Die Space	6 in.	8 in.
Locking pressure (Tons)	90	110
Weight	14300	16500



Above two cut show principle of operation, "G" type machine.



NO. 1½G HYDRAULIC HIGH PRESSURE DIE CASTING MACHINE — FOR ALUMINUM, BRASS, MAGNESIUM OR ZINC.

SPECIFICATIONS

	No. 1½G	No. 2G
Approximate size of die plates	28x29 in.	32x37 in.
Space between bars	15x18 in.	18x21 in.
Die opens	10 in.	12 in.
Max. Die Space	18 in.	24 in.
Min. Die Space	6 in.	8 in.
Locking Pressure (Tons)	90	110
Weight	11250	14100

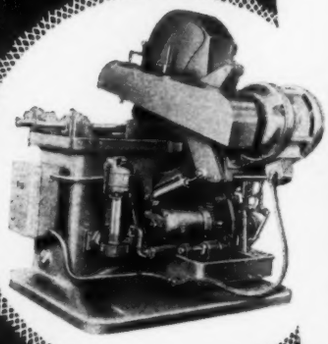
We solicit your die casting problems and offer a complete Die Casting Service including Machines, Dies, Design, or die cast parts in Zinc, Tin or Lead base alloys, Aluminum, Brass and Magnesium.

REED-PRENTICE CORP.

WORCESTER · · · MASS., U. S. A.

DIE CASTING MACHINES
PLASTIC INJECTION MOLDING MACHINES
LATHES, ENGINE, TOOL ROOM, AND PRODUCTION
DIE SINKING MACHINES
VERTICAL MILLING MACHINES
JIG BORING MACHINES
SPECIAL PRODUCTION MACHINERY

The Vital Cutting Problems of many leading manufacturers are being solved by the CAMPBELL CUTAMATIC



● Many material cutting problems that vitally affect the production plans of leading manufacturers are being solved by the **Campbell Cutamatic.** This efficient machine is doing many jobs beyond the ability of other machines.

As it cuts hard alloy steels up to 6 inches in diameter—at the rate of a square inch each 12 seconds—the **Cutamatic** smooths the cut pieces, disposes of burrs, removes any danger of burning or case-hardening.

Write for the booklet *"Two Operations in One."* It may suggest the solution of your own cutting problems.

BUY ACCO QUALITY *in Campbell Cutting Machines, Ford Chain Blocks and Trolleys; Page Welding Electrodes; American Chains; Lay-Set Preformed Wire Rope; Reading-Pratt & Cady Valves; Page Wire Fence.*

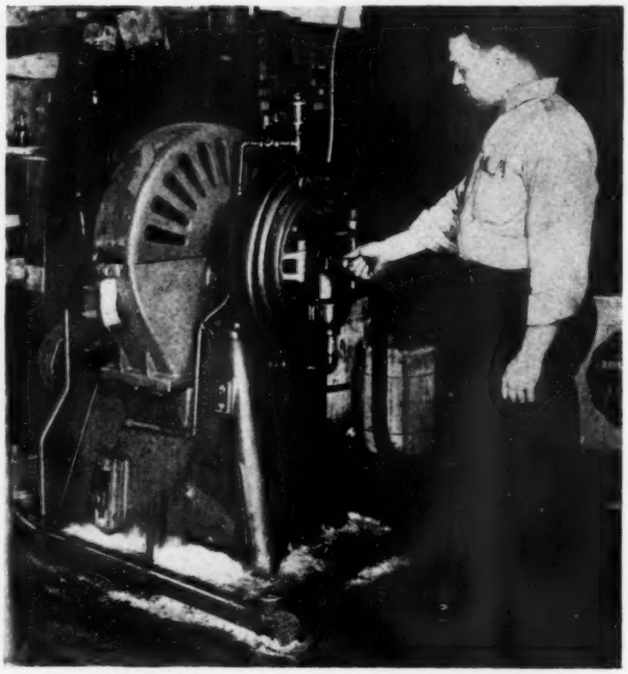
ANDREW C. CAMPBELL DIVISION
Designers and Builders of Special Machinery
BRIDGEPORT, CONNECTICUT

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.

MAKING SAFETY A CERTAINTY . . .

At a Profit WITH ETNA SWAGING MACHINES



The Above Photograph Shows a Production Operation That Calls for Dependable Performance—Swaging Fittings On To Flexible Cables for Automobile Brake Assemblies and Airplane Controls—And It Is Profitably and Rapidly Handled With This ETNA SWAGING MACHINE!

● Since putting ETNA Swaging Machines to work on this specific job (which is one that requires outstanding finished product dependability), this manufacturer is making *safety* a *certainty* on every job that leaves his shop—and *at a profit too.* The machine shown here, like every ETNA unit, is a *consistent* performer—the product of more than a quarter century of qualified experience. The ETNA *drum* is of alloy steel securely mounted on the base; *Timken Bearings* carry the main load on the spindle and thrust; the spindle is an alloy steel forging, heat treated and ground; the *hammers, rolls* and *inner ring* are of carefully selected alloys, and the *motor* is mounted on an adjustable bracket. ETNA Swaging Machines are built in capacities of ⅜" to 4" diameter with die lengths 1" to 18". Larger sizes built to order.

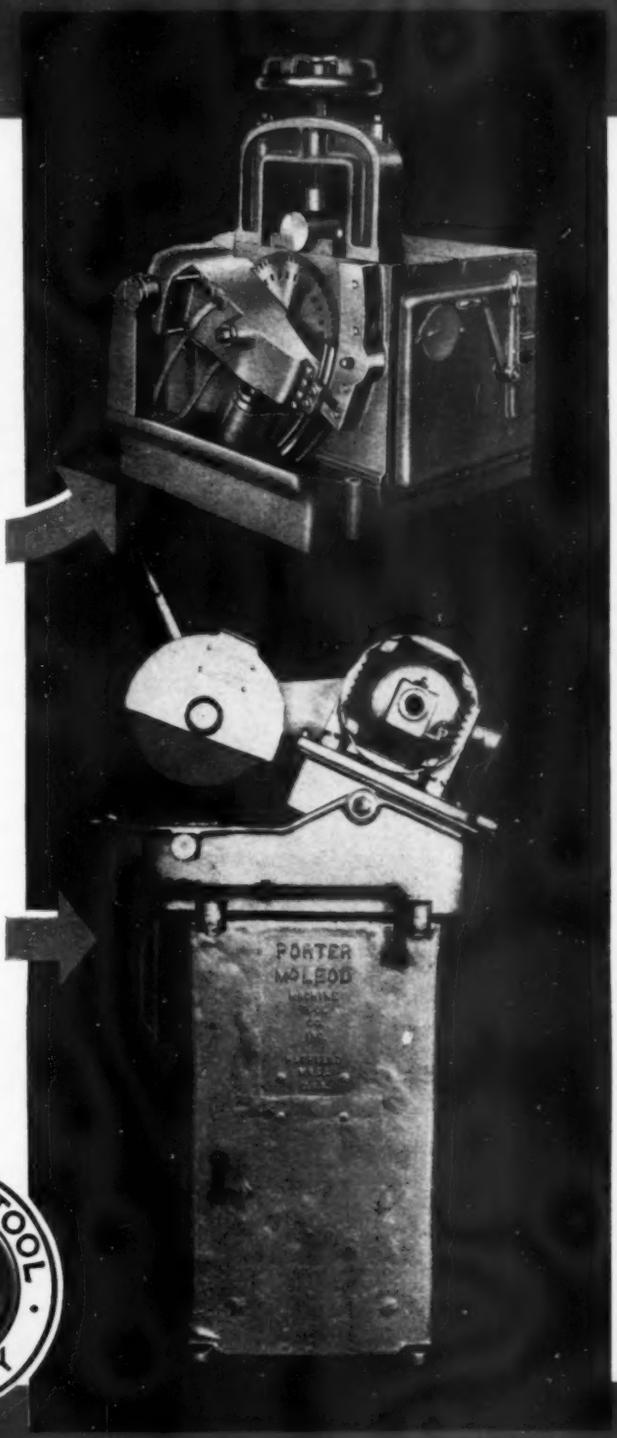
WRITE NOW FOR LATEST BULLETINS

THE ETNA MACHINE COMPANY
3400 Maplewood Ave. Toledo, Ohio

YOU CAN SAVE MONEY..

by HANDLING YOUR METAL SAWING AND CUTTING-OFF ON THESE

MODERN, FAST MACHINES



The 8" Porter-McLeod Cold Metal Sawing Machine

This new machine has a capacity of 8 inch round and 7½ inch square. A special holding fixture makes it possible to handle multiple cutting up to the capacity of the machine. For example, it will cut three pieces of round stock 4½ inches in diameter simultaneously or smaller sizes in greater quantity.

Features of design which are well worth your investigation include: upward feed of blade to stock by which riding and bumping are prevented; friction disc feed which protects blades against breakage; pulling of blades through cut from in front of and below on a diameter well out from the center of the blade, a construction which eliminates weaving and buckling. These and other advanced features insure convenience, improved performance and worthwhile savings in cold metal sawing. Write for complete Illustrated Bulletin, giving detailed specifications.

The New One Inch Porter-McLeod Wet Abrasive Cutting-Off Machine

Designed for high speed work without discoloration, corrosion or splash, this new cutting-off machine insures fast, square, clean cuts. A turntable is provided which may be set in 5° steps in either direction for cutting at angles up to 45°. With special angle blocks available, this machine can be adapted to cutting any angle.

These machines are available in Bench and Pedestal Types and are equipped with 1½ H.P. motors driving spindle through three V-belts. On each type machine, coolant is brought in through the side of base and directed to a chamber directly under the turntable. Coolant then passes through an orifice in the center of the turntable to each side of work. This method of cooling keeps work cold, kills most of the spark and prevents discoloration. Splash also is eliminated.

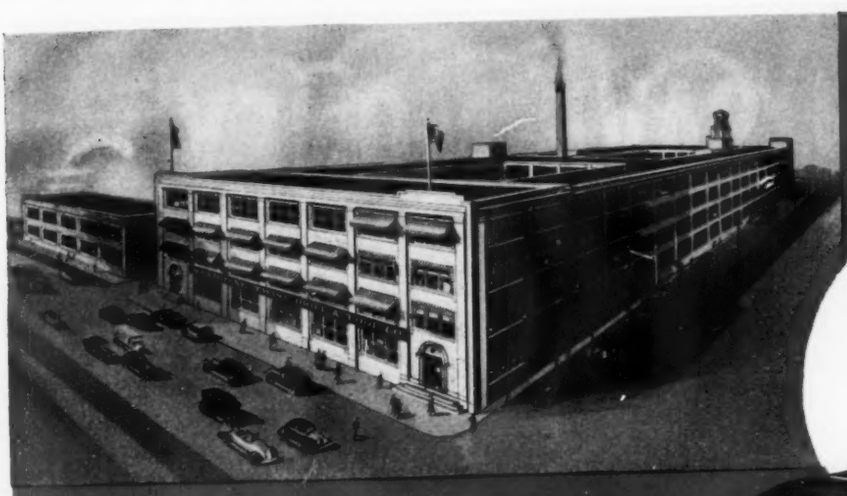
Operating lever is arranged for convenient operation by either right or left hand.

Other important features and detailed specifications are available in Illustrated Bulletin which will be sent promptly on request.

MACHINE TOOL COMPANY

PORTER-McLEOD MACHINE TOOL CO., INC.

HATFIELD, MASS., U. S. A.



Metal Tools for

● Present day demands are for Metal Cutting Tools of near perfection.

● NATIONAL Twist Drills, Reamers, Milling Cutters, Hobs and other Tools have a background of Research, Engineering and Manufacturing facilities designed to discover and present to Industry the last word in metal cutting performance.

NATIONAL TWIST DRILL & TOOL DETROIT U.S.A.

TWIST DRILLS
REAMERS, HOBS
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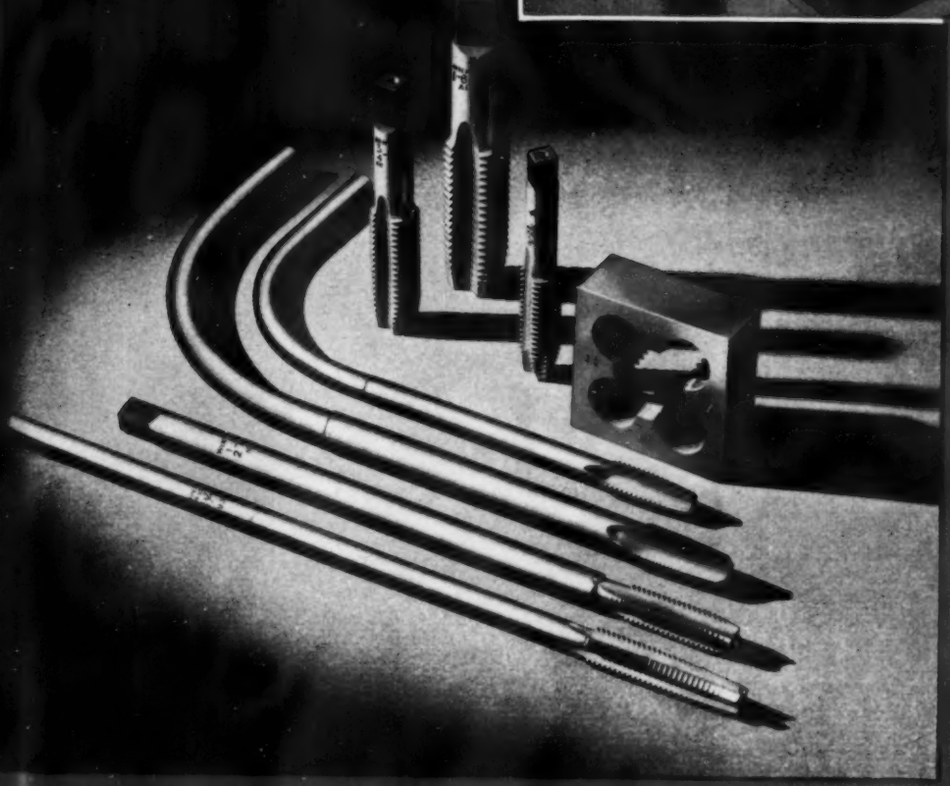
Cutting Industry



● The name Winter Brothers has been synonymous with good Taps and Dies since our production and precision era began.

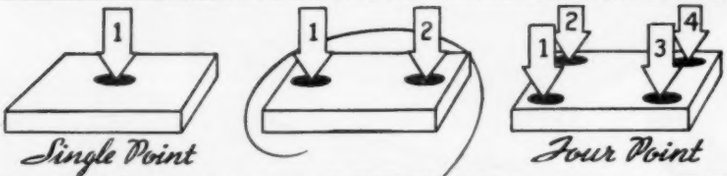
● WINTER Taps, Dies and Engineering Service today virtually assures the economical production of fine threaded work.

WINTER BROTHERS CO.

MAIN FACTORY—WRENTHAM, MASS. • BRANCH FACTORY—DETROIT, MICH.

A Division of the NATIONAL TWIST DRILL & TOOL COMPANY

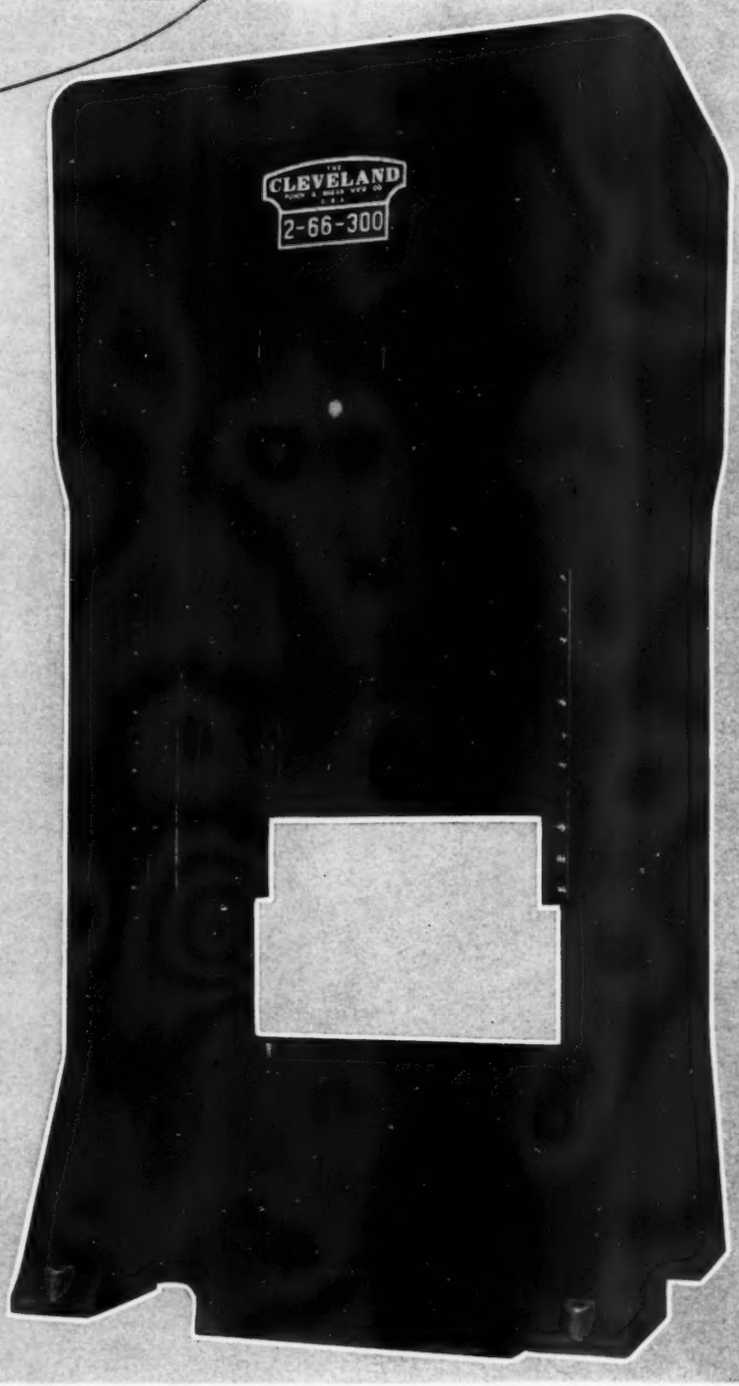
Modern Presses



Single Point

Four Point

Two Point



Modern Cleveland Presses of this series are built in three types: Single Point, Two Point and Four Point, and each of these types can be furnished in sizes and capacities to suit particular requirements.

On the Single Point Presses the connection is located in the center of the slide. On the Two Point Presses there is a connection at each side of the slide and on the Four Point Presses there is a connection at (approximately) each corner of the slide.

The illustration shows a Cleveland Two Point Press, 66" between the uprights, which exerts a pressure of 300 tons and, like all other Modern Cleveland Presses of this series, the Press is symmetrical front and back, consequently there are no overhanging brackets or other projections.

The gears, which run in a bath of oil, are located in the box type crown together with the drive unit, and both the gearing and the drive unit can readily be removed whenever necessary.

The Press is equipped with a Cleveland pneumatic cushion in the bed and this arrangement gives the Press most of the advantages of a double action Press.

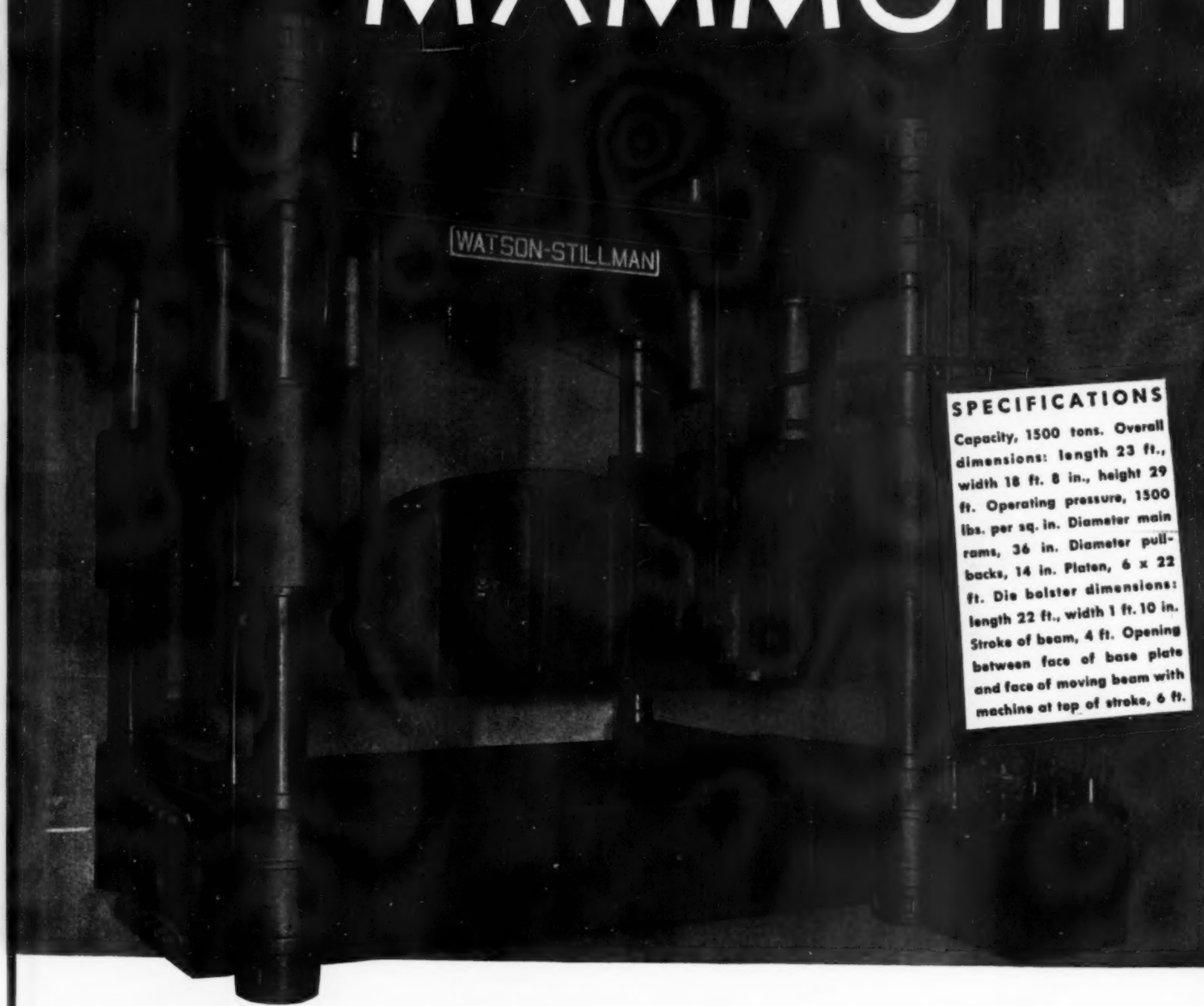
Cleveland Presses can be furnished with either a pneumatically operated friction clutch and brake or with an equally efficient hydraulically operated friction clutch and brake, as desired.

Complete information on all three types of Modern Cleveland Presses will gladly be furnished on request.

Modern Presses **THE CLEVELAND PUNCH & SHEAR WORKS COMPANY** *Cleveland, Ohio*

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

METALWORKING MAMMOTH



SPECIFICATIONS

Capacity, 1500 tons. Overall dimensions: length 23 ft., width 18 ft. 8 in., height 29 ft. Operating pressure, 1500 lbs. per sq. in. Diameter main rams, 36 in. Diameter pull-backs, 14 in. Platen, 6 x 22 ft. Die bolster dimensions: length 22 ft., width 1 ft. 10 in. Stroke of beam, 4 ft. Opening between face of base plate and face of moving beam with machine at top of stroke, 6 ft.

As in all shipbuilding operations, the machines used in construction or parts fabrication must be both highly efficient and exceptionally rugged — and often built to special design.

The qualities of fitness built into this 1,500-ton-capacity W-S Keel Plate Bending Machine are inherent in all Watson-Stillman hydraulic machinery . . . and are the result of quality standards established through more than 85 years of W-S manufacturing experience in the field of Hydraulics.

For hydraulically-operated machinery of any type . . . machines designed to achieve fast, high-quality, low-cost production . . . you may safely consult the W-S engineers.

THE WATSON-STILLMAN COMPANY, ROSELLE, N. J.

WATSON-STILLMAN

Fast...Accurate...Economical

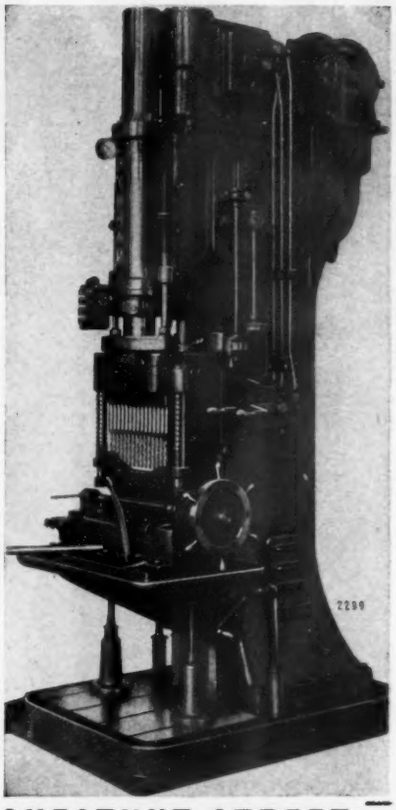
Drilling and Honing

For Army, For Navy, For Peace

BARNESDRIL Self-Oiling, All-Geared Drilling Machines, Hydrams, and Honing Machines are leaders in commercial high-production manufacturing . . . equally prominent in modern arsenals, navy yards and aircraft factories.

Our Drilling Machines are made in simple single-purpose types; with All-Geared Quick-Change Speeds and Feeds; and in the Hydram type which has hydraulic feed. They are built in Single-spindle, Gang, and High-Production Units. Their range for drilling, boring, tapping, and similar operations is from 3/8" to about 4" diameter.

BARNESDRIL Hydraulic Honing Machines, Internal and External, are pioneers in the field, thoroughly modern; extremely accurate, efficient, and economical. They are built in many different sizes and types, to hone anything for which a hone can be made even though it require more than 75-foot stroke or exceed 30" diameter.

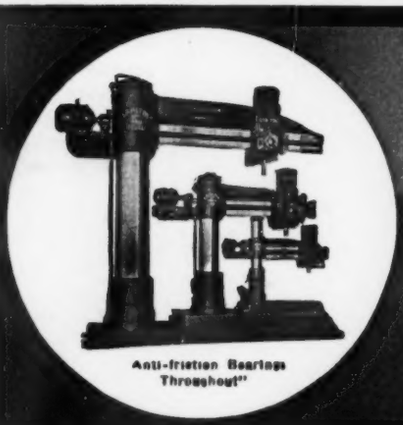


Illustrated is one of the many Hydrams (and other machine-tools) that we have developed for government service. It has an especially interesting fixture and multiple spindle head of our own design. Write for details of this, and many other applications of BARNESDRIL Honers and Drilling Machines. Ask for Catalog A.

DRILLERS BARNESDRIL HONERS BARNES DRILL CO.

Barnes Drill Co.

830 CHESTNUT STREET
ROCKFORD
ILLINOIS, U.S.A.



—SPECIAL FEATURES—

1 — LOW HUNG DRIVE TO THE SPINDLE 2 — ALL POWER DRIVEN PARTS RUNNING IN OIL 3 — QUIET RUNNING AT ALL SPEEDS 4 — CONCENTRATED AND CONVENIENT CONTROLS 5 — CONSTRUCTED ON UNIT PRINCIPLE

The CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U.S.A.

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Divisions of GENERAL MACHINERY CORPORATION Hamilton, Ohio

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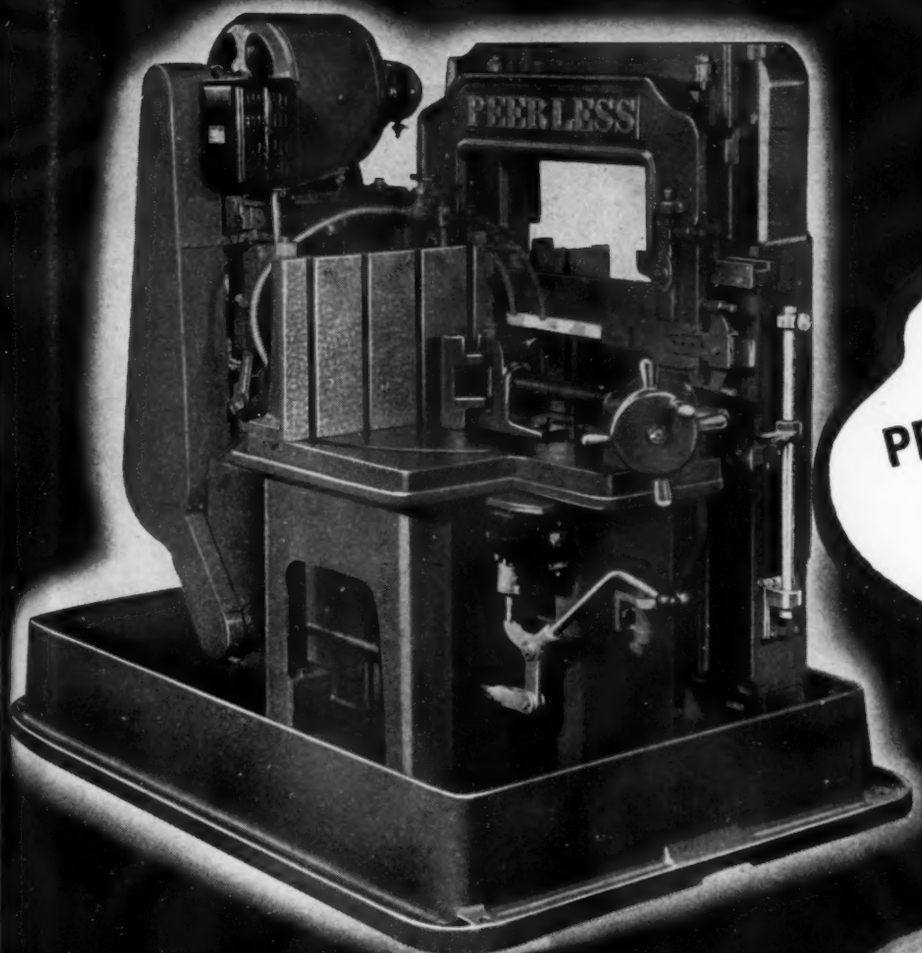
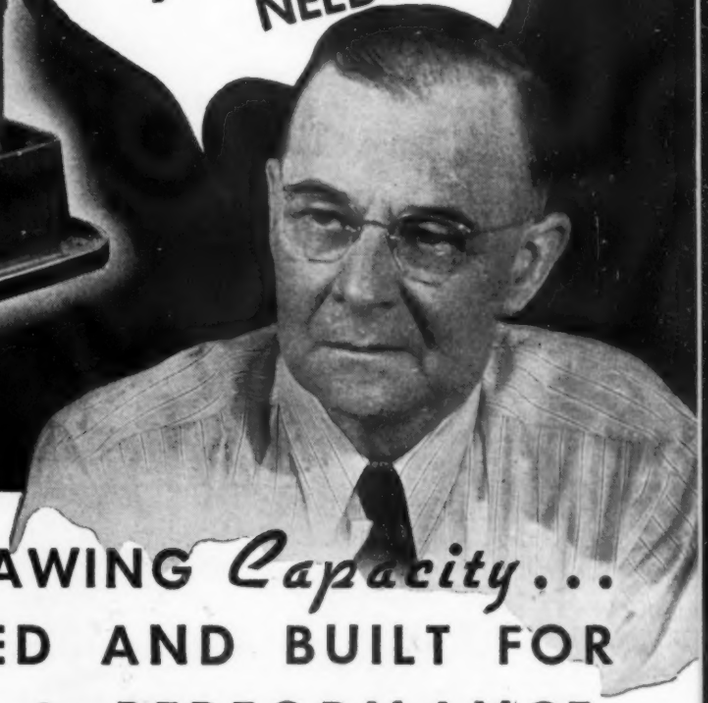


Plain 14" x 14" Peerless Hydraulic — takes single bars up to 14" x 14" on straight cutting and up to 9" x 14" at 45° angular cutting.

WHAT'S THE PEERLESS HYDRAULIC *Got* THAT WE NEED?

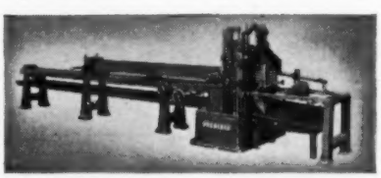


Answer: REAL METAL SAWING *Capacity*... BECAUSE IT'S DESIGNED AND BUILT FOR FASTER, *More Accurate* PERFORMANCE!

Production men in leading industrial plants rely on the Peerless organization — with its 25 year experience record — for the most advanced developments in metal sawing machines.

And the Peerless High Duty—the only fully hydraulically controlled metal sawing machine — is a typical example of Peerless engineering and manufacturing skill.

Designed and built for heavy duty production sawing, this machine embodies every feature that makes for greater capacity, faster and more accurate performance on all classes of work.



6"x 6" Bar Feed Controlled hydraulically—Peerless Saws are available in a wide range of types and sizes: High Duty Hydraulic — Vertical Hydraulic — Universal and Standard Types with mechanical feeds. Write for bulletins.

Peerless is the only hydraulic saw equipped with a Four-Sided Saw Frame — the frame that completely surrounds the saw and the work — holds the blade with a tension and rigidity never before possible — provides positive blade control — prevents bowing of the blade — permits blade to lift clear on every return stroke — blades last longer.

In scores of plants this machine has set new records for continuous metal cutting — find out what it can do in yours. Write for Bulletin No. 50.

PEERLESS MACHINE COMPANY
RACINE, WISCONSIN

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

Peerless METAL SAWING MACHINES

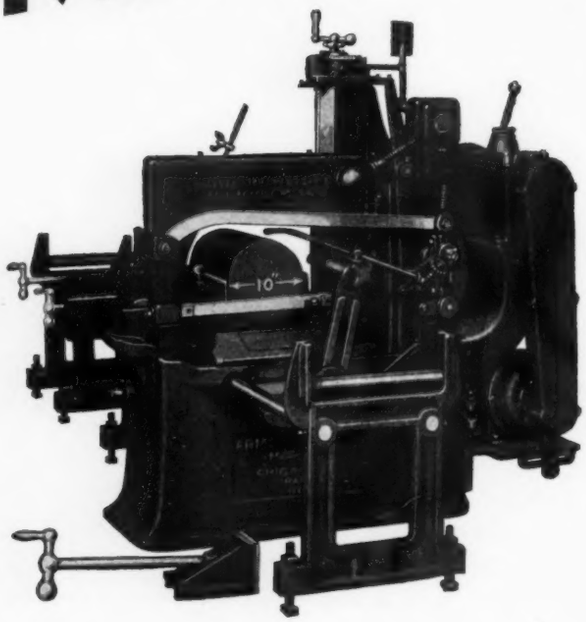
10" x 10" Capacity

and more pieces cut-off from bar per hour than by any other methods

Strictly production machine tools built for continuous high speed operation, Marvel 9A Saws automatically feed single or nested bars, accurately measure and cut-off thin slices or long lengths at extremely high speeds. Stop automatically when completing desired number of pieces.

MARVEL

No. 9A Production Saw



- Full ball-bearing construction throughout. Combination positive-and-friction feed. Depth gauge will raise blade at any desired depth of cut, (for notching or slotting). Blade always horizontal, cuts on draw stroke, raises out of cut on fast return. Rigid saw frame is reciprocated by crank lever or shaper link action (33 1/3% faster than ordinary crank action). Serves as both production and fast, accurate, general purpose saw. Automatic bar push-up can be disengaged at any point, a miscellaneous cut made, and production work resumed immediately.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave., Chicago, U.S.A.

Eastern Sales Office: 199 Lafayette St., N. Y.

PRECISION STAMPINGS

PRESTEEL QUALITY

WORCESTER PRESSED STEEL CO.

WORCESTER, MASSACHUSETTS

You can specify "PRESTEEL" with confidence

For Fast, Accurate Set-Ups

Universal Vise

Universal Angle Plate

The WESSON all Steel U-NIVERSAL VISE

Gives you faster set-ups and greater accuracy. No more tedious or makeshift measuring. Accurately graduated in all planes. Sturdy cradle design and all-steel construction give greater rigidity, permit faster stock removal. Two sizes, priced for every shop. Can be furnished with slotted surface plate for use as universal angle plate. SEND FOR FREE FOLDER.

WESSON CO., 1050 Mt. Elliott, Detroit, Mich.

Please send me illustrated Folder covering the Wesson Universal Vise.

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Dependable

To deliver—unfailingly and on schedule. That's dependability . . . It's solely on that kind of a reputation that JACOBS CHUCKS are selected to do most of the world's tool holding.

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THE JACOBS MANUFACTURING COMPANY

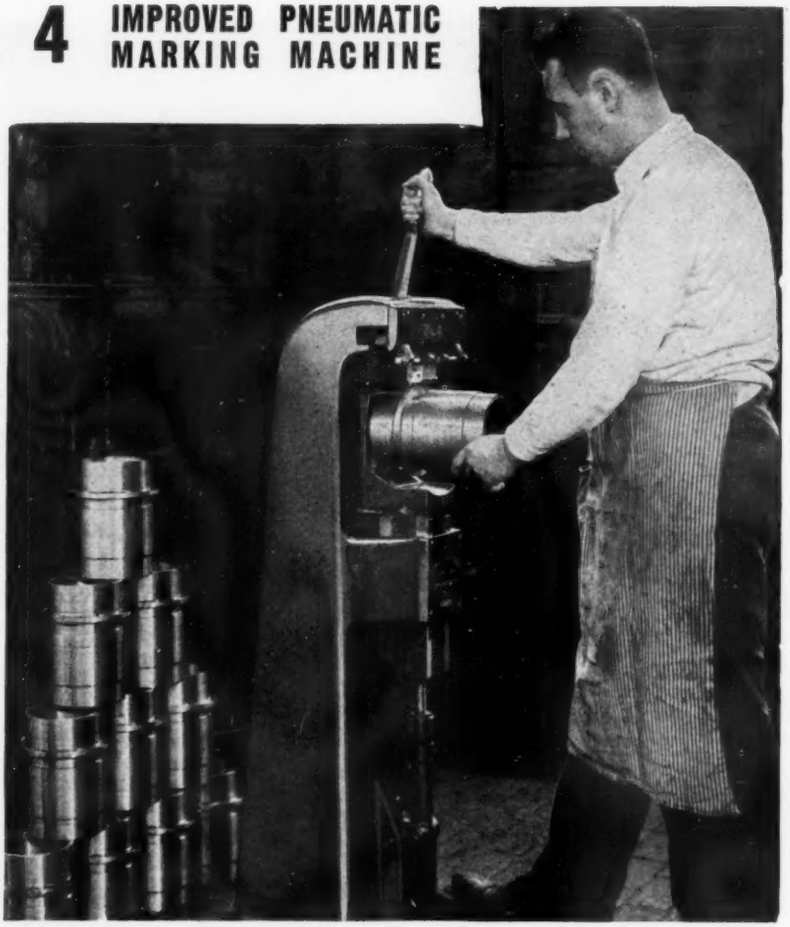
HARTFORD CONN., U.S.A.

IF IT'S A *Jacobs* IT HOLDS!

NOBLEWEST NO. 4 IMPROVED PNEUMATIC MARKING MACHINE

for marking

WASP ENGINE PARTS



In the Cylinder Department of the Pratt & Whitney Aircraft Shops is this newly designed "Noblewest" No. 4 Pneumatic Marking Machine—shown here in action, marking cylinders for the famous Wasp Aircraft Engines. Chosen by Pratt & Whitney for its adaptability to ease and speed-of-operation, this No. 4 machine features a generous capacity, perfect accessibility and visibility, foot pedal for great air pressure with little effort—and sharp, fine, exact markings from dies which can be flat for use on round surfaces or round for use on flat surfaces. This, the most recent of the Noble & Westbrook line, is a general-purpose machine, carefully engineered and constructed to operate at a minimum overhead for a long period of time. Many additional models for all kinds of Rapid, Precision Marking, Numbering and Graduating are available for quick delivery. Send your inquiries to the leader in this specialized field . . .

NOBLEWEST IMPROVED MARKING DEVICES

NOBLE & WESTBROOK MANUFACTURING CO.

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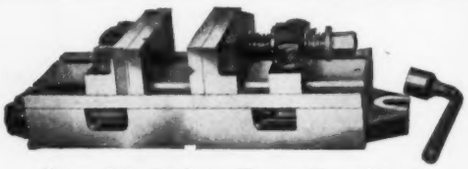
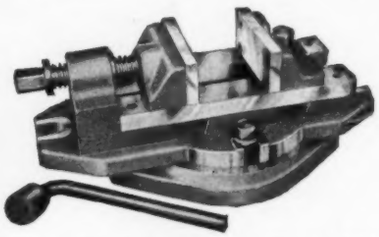
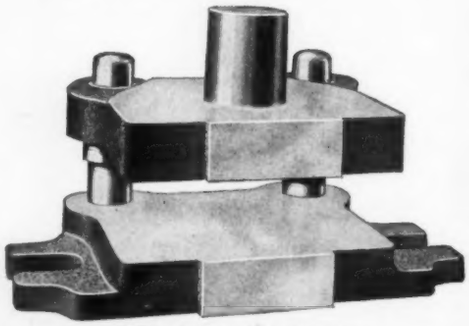
EAST HARTFORD, CONN.



Heavy Duty Producto Vise—a 6" model with double the capacity and durability of ordinary Machine Vises.



Producto 4½" General Purpose Vise—available in plain and swivel types.



A Standard Producto Die Set

Modern PRODUCTO *Improved*

TOOLS

MACHINE VISES . . . *insuring greater accuracy in long hard service.*

With Producto Vises you can handle heavy duty production milling and drilling operations as well as small part production with utmost precision and speed. You can depend on Producto equipment for holding work securely and safely.

Bodies are of semi-steel castings, reinforced with hardened and ground wearing and jaw guide plates. Jaws are accurate in any position, work is clamped on hardened surfaces. Send for bulletin #25 giving complete details.

DIE SETS . . . *offering an almost unlimited selection of standard designs.*

Producto Die Sets are assembled and shipped from 3 points—at our own factories in Bridgeport, Connecticut and Detroit, Michigan and at the Die Supply Company, 1390 East 30th Street, Cleveland, Ohio.

Die Sets are also stocked at Joseph C. Fletcher, 1415 Folsom Street, San Francisco, California and Frey Industrial Supply Company, 3828 Santa Fe Avenue, Los Angeles, California.

Standardize on Producto and keep down your investment in dies. Full details on request.

Ask for our 100 page Catalog

THE PRODUCTO MACHINE CO.

BRIDGEPORT, CONN., U. S. A.

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We are also Distributors of DICKERMAN AUTOMATIC PRESS FEEDS. Write for information.

Customers Say:
"CLE-FORGE HIGH SPEED DRILLS PRODUCE MOST HOLES PER GRIND, MOST GRINDS PER DRILL"
Are You Drilling Small Holes in Crankshafts... or Big Ones in Bedplates?

You scarcely could name a more exacting job than the *multiple* drilling of oil holes in nickel-steel crankshafts.

Nor, by contrast, a simpler one than drilling bedplates, frames, etc., of grey iron through accurately-spaced fixtures.

Yet, on a moment's notice, The Cleveland Twist Drill Company can supply Tools to work successfully not only these two extremes, but any other material that *can be* drilled—ferrous or non-ferrous metals, fiber, or plastics.

This Company's resourcefulness in supplying Drills and Reamers, correctly formulated to meet your exact drilling requirements, and to measurably reduce your drilling costs, is based upon long years of continuous research by capable Engineers in Metallurgy, Design and Application Research.

Their experience is fully at your call on any Drilling problem—they will join you in analyzing drilling operations in your own Plant, and will make practical suggestions, without obligating you. Telephone a "Cleveland" Stockroom or your usual source of supply.

We favor adequate Preparedness for National Defense

The CLEVELAND TWIST DRILL COMPANY
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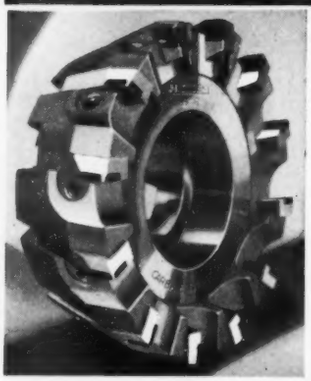
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

All kind to Carbide

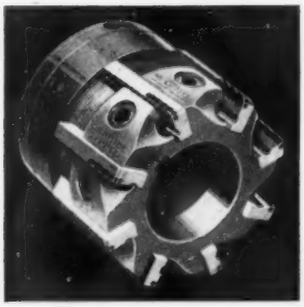


McCROSKY COST CUTTING TOOLS

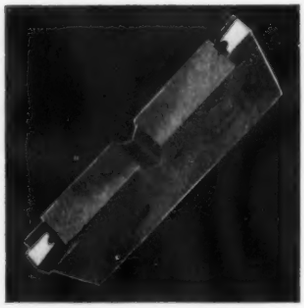
In McCrosky JACK-LOCK Milling Cutters carbide-tipped blades can be locked and unlocked without hammering

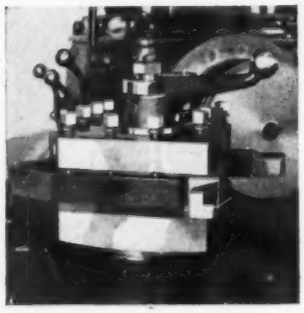
And carbide-tipped blades in McCrosky JACK-LOCK Cutters can be uniformly and economically adjusted by individual adjusting screws, one behind each blade

Body design of McCrosky SUPER Adjustable Reamers provides full support for carbide tips and ample chip clearance



Carbide-tipped blades in McCrosky Adjustable Boring Blocks are held rigid and quickly and economically adjusted



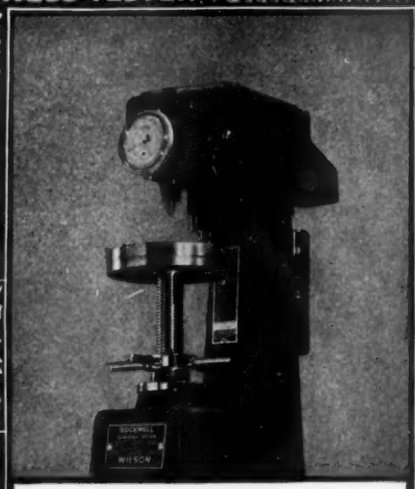


McCrosky Turret Tool Posts for engine lathes provide rigidity and indexing accuracy for top carbide performance

There's a 16-page McCrosky Bulletin on each of the tools shown above. Ask for a copy

McCROSKY TOOL CORPORATION
1340-70 MAIN STREET. MEADVILLE, PENNA.
COST CUTTING TOOLS

"ROCKWELL" HARDNESS TESTER



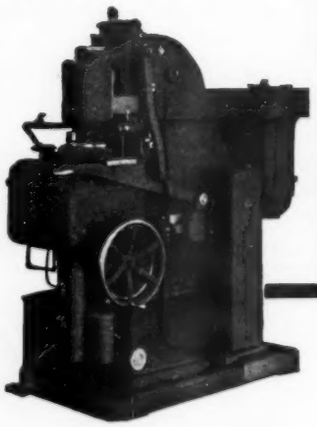
Whoever enters your shop and sees one of these testers knows you are striving to do good and conscientious work, for the reliability of these testers is widely appreciated.

WILSON
MECHANICAL INSTRUMENT CO., INC.
Concord Avenue, N. Y. City

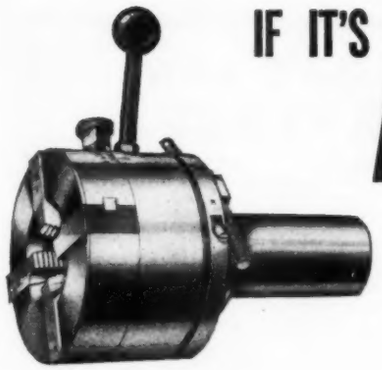
WALKER

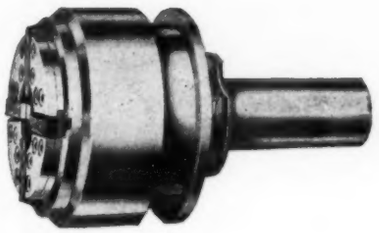
IMPROVED ROTARY SURFACE GRINDER

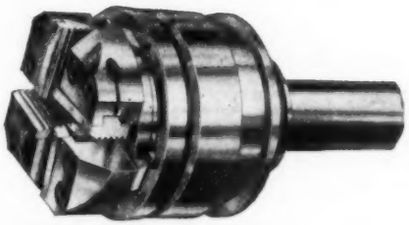
Raising or lowering wheel head automatically starts or stops the table and magnetizes or demagnetizes 12" magnetic chuck. Other features include wheel head locking device and adjustment of upper portion of column for grinding saws, cutters, etc., having hubs up to 6" diameter. Six table speeds are available and a foot brake facilitates quick stopping of table.

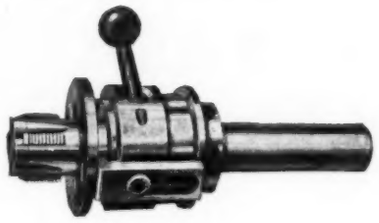


O. S. WALKER CO., INC.
WORCESTER, MASS.









IF IT'S

ACCURATE SCREW THREADS

YOU WANT

Specify GEOMETRIC

Here are a few reasons why you can count on accurate screw threads from Geometric Die Heads, Taps and Threading Machines.

1. You have a wide choice of tools, enabling you to pick one just adapted to the work and to the machine on which the work will be done—you don't have to use a makeshift tool.

2. On external threading you have a wide choice of Chasers — Tangent Chasers, Circular Chasers, Milled Chasers, Tapped Chasers—Where else can you get such a choice?

3. You get Chasers, hardened by experts under closely controlled temperature ranges; you get Chasers that are checked and rechecked until you can be sure they are right; you get the benefits of the experience of a concern that has devoted over 45 years exclusively to the production of tools and machines for producing screw threads.

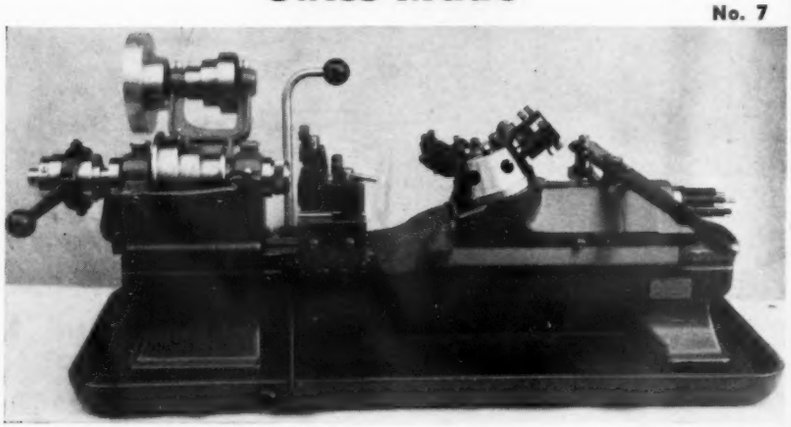
Self-Opening Die Heads
Solid Adjustable Die Heads
Collapsing Taps
Solid Adjustable Taps
Threading Machines

THE GEOMETRIC TOOL COMPANY
New Haven, Conn.

COSA **HIGH PRECISION**

BENCH, TURRET AND FINISHING LATHES
Swiss Made

No. 7

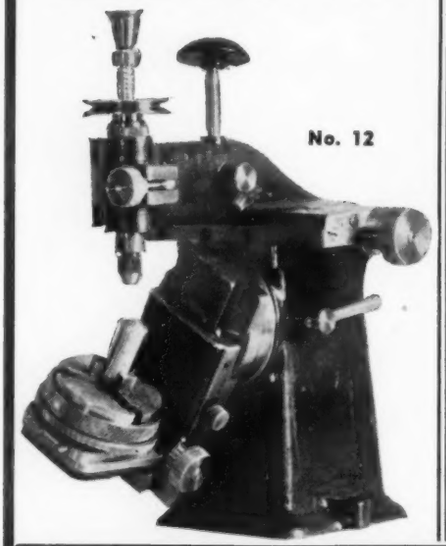


Swing 5.15" — 5.5" — 7.1" — 8.05" — 9.45"

Large quantities are available on short delivery; some machines are in stock.

Write for catalog giving detailed specifications.

SENSITIVE TAPPING MACHINES up to .079".



No. 12

COSA OVERSEA TRADING CORPORATION
5000-04 Chrysler Bldg., New York, N. Y.
Phone: Murray Hill 4-5365

***Today* NATIONAL DEFENSE Production Requires Speed**

SAVE TIME WASTE

use the BARKER Wrenchless Chuck

Don't let wrenching and adjusting waste your production time—keep your lathes working and not waiting. With the Barker Wrenchless Chuck the usual chucking time is put into actual production. It can be adapted to any type of work that may be done on turrets, engine lathes, semi-automatic or pipe threading and cutting off machines. Users everywhere are getting high percentage increases in production—You can get similar results as soon as you put the Barker to work.

The Barker Wrenchless Chuck is simple and sturdy in construction—it is compact—requires no accessories to install. It permits bar work to spindle capacity. A quick movement of the lever releases or grips the work. Well adapted for a diversified line, from small brass castings to heavy forgings. Write today and get full details.

PROMPT DELIVERIES.

THOMAS HOIST CO.
Chuck Division
18 So. Hoyne Ave.
CHICAGO, ILLINOIS

THE *BASA HAMMER

HAS PERFECT BALANCE..

In *Basa Hammers the weight is scientifically distributed for perfect balance. The mechanic fairly *"feels"* its sweet control. The design of the *Basa Hammer permits of quick replacement of the striking faces without injury to the hammer or the faces. Last a lifetime. Faces available in specially treated Rawhide, Copper and Babbitt. You get more for your money when you specify Greene, Tweed "Basa Hammers."

*Reg. U.S. Pat. Off.

GREENE, TWEED
REPLACEABLE FACE
HAMMER

and EMPIRE all-rawhide mallets

GREENE, TWEED & CO., 101 Park Avenue, New York, N. Y.

Try VICTOR'S

HIGH SPEED

TWIST DRILLS

ONE OF THE FINEST

POLISHED FLUTES

Sizes ranging from 1/16 to ½ in. by sixty-fourths, also Nos. 1 to 60 and Letter Sizes A. to Z. Also drills 12 in. long. 7/32 to ½-in., with 9-in. cutting flutes.

Send for Catalogue

VICTOR MACHINERY EXCHANGE

251 CENTER STREET, NEW YORK, N. Y.

KENNAMETAL

SETS NEW PERFORMANCE RECORDS

in TURNING BORING SHAPING

and MILLING **ARMAMENTS**

TURNING SHELLS

Style No. 11 TURNING and BORING Tool.

Operation: Rough turning 75 mm. shells.

Material: X 1335 drop forging.

Speed: 196 ft./min.

Performance: 40 seconds machining time. One minute floor to floor time. 2¾ lbs. of metal removed per minute. 200 pieces per grind of tool.

BORING AIRPLANE STRUTS

Operation: Roughing and finishing airplane struts.

Material: SAE 4150 heat treated forgings. Hardness—402 Brinell.

Speed: Roughing—125 ft./min. Finishing—150 ft./min.

Performance: High speed steel was unable to machine this material. Another carbide cutting material failed completely. KENNAMETAL performed satisfactorily in every way.

SHAPING ARMOR PLATE

Style No. 20 SHAPER Tool.

Operation: Remove 5/32" from 1" x 18" x 18" Armor Plate.

Material: Cast alloy steel with extreme hard spots and sand pockets. Hardness—42 Rockwell C.

Speed: 60 ft. per min. as compared to 11 ft./min. for high speed steel.

Performance: KENNAMETAL averaged 31" between tool grinds as compared to 8" per grind for high speed steel. There was no cratering or chipping of the KENNAMETAL tip.

MILLING AIRPLANE PARTS

Operation: Milling aluminum airplane parts.

Tool: 3½" milling cutter tipped with KENNAMETAL grade KH.

Speed: 1800 r.p.m. or about 1600 ft. per min.

Performance: The cutter has been in use every day for four months without being sharpened.

Whether or not you manufacture armaments or other equipment for National Defense, KENNAMETAL-tipped tools will greatly reduce machining time on your steel parts—regardless of the operation. Write for complete information—today.

IMPORTANT NOTICE:

KENNAMETAL tools cost no more than ordinary carbide tools — see our new price schedule.

SHELL END MILL with KENNAMETAL-tipped blades.

McKENNA METALS Co.

103 LLOYD AVENUE

LATROBE, PENNSYLVANIA, U.S.A.

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Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
200 Broadway

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CLUTCH OR CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down.

Style C Graduated Adjustable Safety Friction.

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

BRING INDEXING OPERATIONS TO TOP-NOTCH SPEED AND EFFICIENCY *with the* HARTFORD SUPER-SPACER

The Hartford Super-Spacer has proved its ability in many shops as a practical, economical, accurate means for speeding up milling, drilling, slotting and planing operations. It reduces set up time on indexing operations and pays for itself quickly whether the work involves single pieces or quantity production, light or heavy cuts.

With the Hartford Super-Spacer you are assured of a dependable, foolproof, error-eliminating method of indexing.

A wide range of drill jig and layout work can also be handled at low cost on the Hartford Super-Spacer by using the Hartford Drilling Attachment.

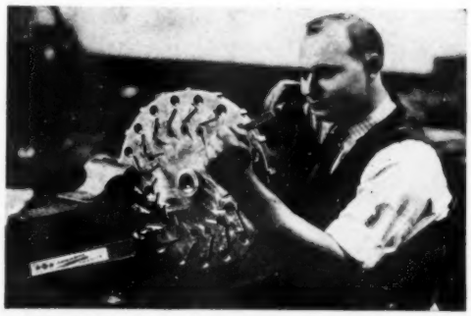
Write Today for full details

THE HARTFORD SPECIAL MACHINERY CO.

HARTFORD, CONN.

Precision Files

that do better, faster work



More than 2500 Shapes, Cuts and Sizes
Cuts Nos. 00, 0, 1, 2, 3, 4 and 6

Hand	Pippin	Mill
Pillar (Regular)	Crochet	Mill (2 Round Edges)
Pillar (Narrow)	Round	Finishing
Pillar (Extra Narrow)	Square	Taper Saw
Half Round	Three Square	Slim Taper Saw
Slim Half Round	Metal Saw	Round Edge Joint
Half Round Ring	Slitting	Square Edge Joint
Crossing	Checkering	Die Sinkers
Knife	Parallel Round	Needle
Warding	Coil or Point	Escapement
Equaling	Half Round (Coarse Cut)	Machine
Barrette	Flat (Coarse Cut)	Die Sinkers' Rifflers
Cant		Silversmiths' Rifflers

WHEN an "American Swiss" Swiss-pattern file bites into a filing job, its keen and uniformly hard teeth get results speedily and accurately.

For 40 years, these American-made precision files have been the choice of experienced tool and die makers and machinists because they have been found to file faster, last longer, and handle the most exacting and intricate work with least effort and at smallest cost.

"American Swiss" makes only one type of file — Swiss pattern; and only one quality — the best, for we believe that "Only the Best is Good Enough."

Buy from our Distributor

Swiss Pattern Files — **Made in U. S. A.**

American Swiss File & Tool Co., Elizabeth, N. J.

American Swiss

Files of Precision

Photo from Wide World Photos, Inc.

..... use OAKITE *Certified Cleaning*

**3 out of 5 manufacturers rated AAAA in Thomas' Register*

WITH the rapidly increasing demand for the myriad of products so essential to both economic progress and National Defense, the need for larger, speedier production schedules is imperative. This is especially true in the case of manufacturers of rifle and revolver cartridges and in other plants contracted to make many other different types of cartridges and shells in connection with the National Preparedness Program.

As these plants gear production to substantially increase volume, every operation must function with precision and economy. Since cleaning is one of these and so important, it must function smoothly . . . create no bottle-necks . . . be performed economically!

For these and other reasons, THREE out of five leading makers of rifle and revolver cartridges use Oakite materials for cleaning brass shells before annealing, for burnishing, cleaning bullets before copper plating and related operations.

IT PAYS TO CHANGE OVER TO OAKITE

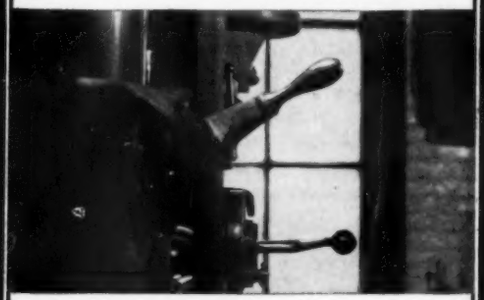
Are you working on Ordnance Production Contracts, Educational Orders or other rush production? Want to speed-up work and save money in cleaning before finishing, inspection or assembly, cleaning aluminum before spot welding or anodizing, or rust-proofing parts? Or perhaps you want to make improvements in cutting and grinding, drawing and stamping. Then you, too, will find "It pays to change over to Oakite". The burden of proof is ours, so write and tell us your particular problems . . . we can help!

Manufactured only by
OAKITE PRODUCTS, INC., 26 Thames Street, NEW YORK, N. Y.
Representatives in All Principal Cities of the U. S and Canada

OAKITE MATERIALS & METHODS *Certified* **CLEANING** FOR EVERY CLEANING REQUIREMENT

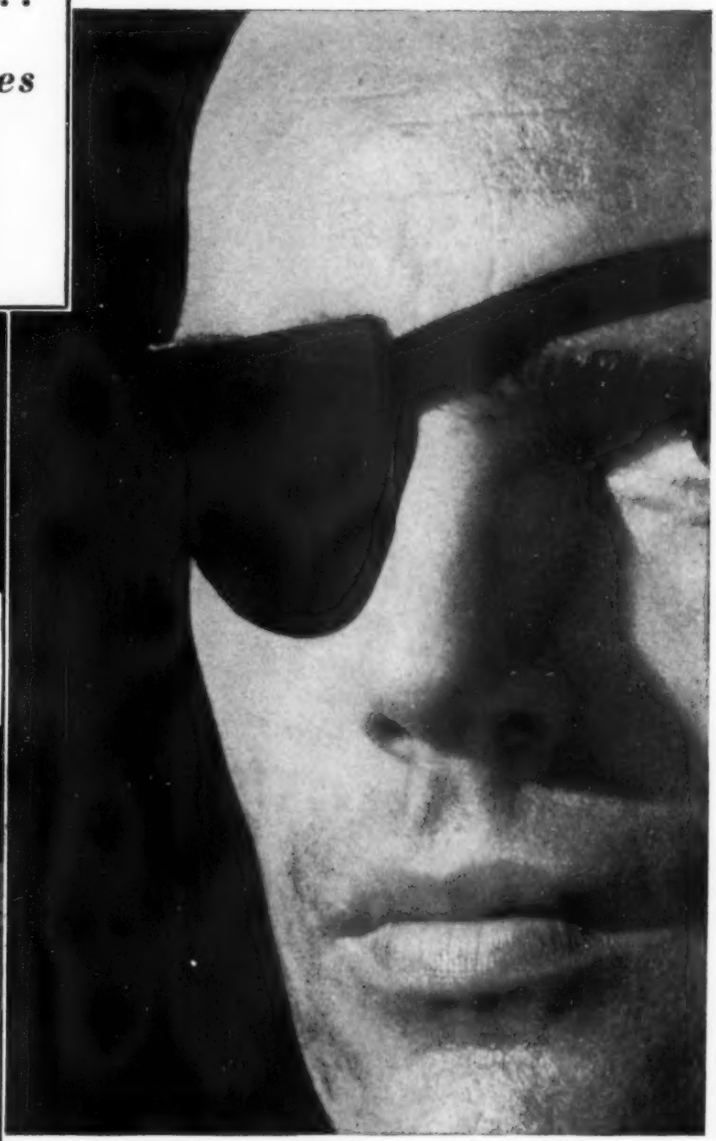
The Cost of an Eye that's Lost... would keep 2,000 eyes AT WORK

LOST MAN HOURS. A chip in the eye can knock a good man out for hours, days . . . or for all time. Don't lose men, or let them lose their skill, when both are so urgently needed for National Defense.



LOST MACHINE HOURS. A chip in the eye can shut down a machine for hours, days . . . *or until you train a new man,* who may not be easy to get. Production is lost. Schedules may be disrupted.

COMPENSATION AND MEDICAL CARE. These costs are more or less insured . . . *but an easily avoidable accident helps no one's risk-rating,* and these costs run on into hidden costs that are *not* insured. Avoid these Losses . . . AMERICANIZE YOUR WORKERS' EYES.

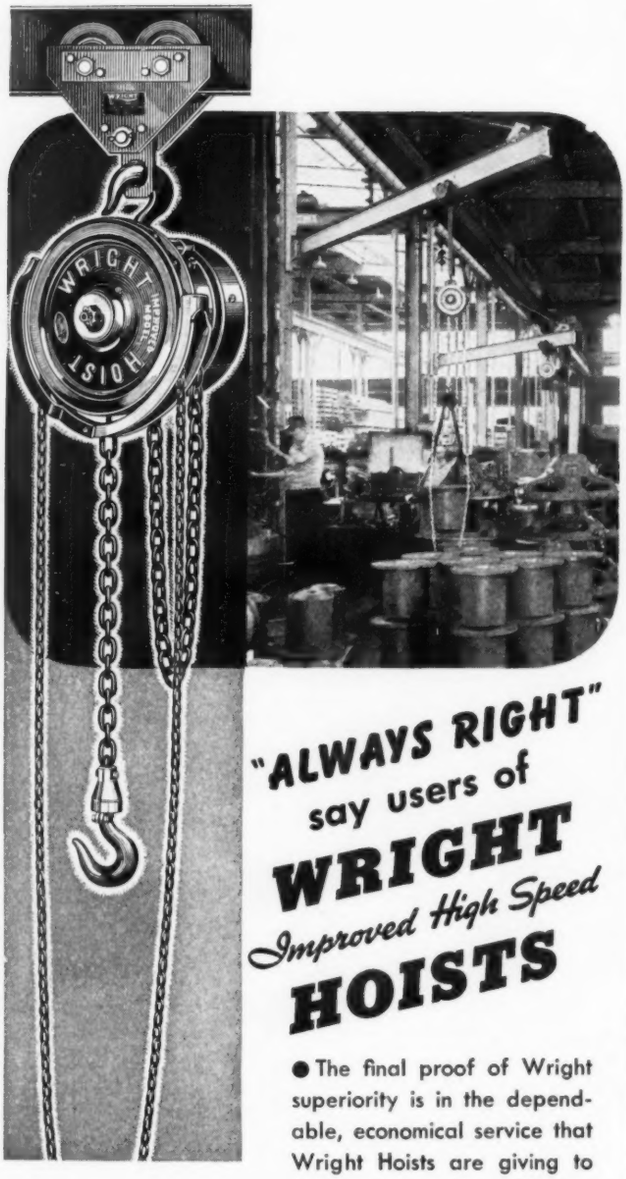


THIS BLACK PATCH would cover the cost of eye-protection for a full-strength regiment of workers . . . good American Goggles that would reduce your eye-liability by thousands of dollars . . . and prevent losses like those at the left.

The plain fact is this: A complete program of American Eye-Protection will return more . . . dollar for dollar . . . than any other equipment investment you can make. Your AO Industrial Representative will show you *for how little* you can give *all* your workers comfortable American Goggles, fitted with Super-Armorplate Lenses, deep-curved for *extra* strength. *Write.*

American Optical Company

Southbridge, Massachusetts, U.S.A.



"ALWAYS RIGHT" say users of WRIGHT *Improved High Speed* HOISTS

● The final proof of Wright superiority is in the dependable, economical service that Wright Hoists are giving to thousands of users. ***"Always Right"*** would well summarize the opinions of these users of Wright Hoists in capacities from ¼ to 50 tons.

There are 21 definite points of Wright superiority—such as precision load wheel bearings which provide fast, smooth, positive action—full zinc coating to resist corrosion—Wright safety guard that always keeps the load chain in the pocket, regardless of operating position.

Write for the Wright Catalog, describing the many advantages of Wright Hoists, Cranes and Trolleys.

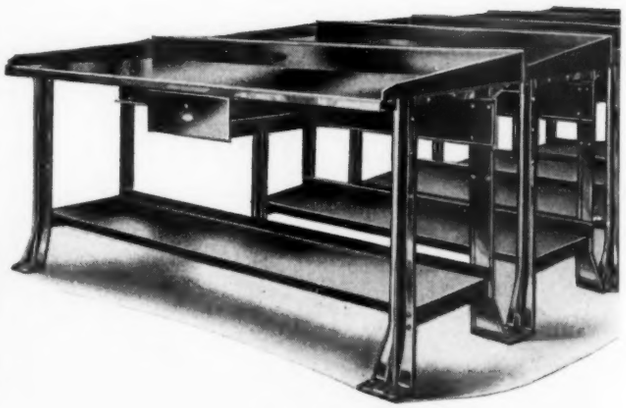
BUY ACCO QUALITY *in Wright Hoists, Cranes and Trolleys; Tru-Lay Preformed Wire Rope; Reading-Pratt & Cady Valves; Campbell Abrasive Cutting Machines; American Chains; Page Welding Electrodes and Page Wire Fence.*

WRIGHT MANUFACTURING DIVISION
YORK, PENNSYLVANIA

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.

In less time, at less cost . . .



"HALLOWELL" STEEL BENCHES

● Instead of building their own benches—which involves extra time and trouble for planning layouts, figuring lumber, buying parts and paying carpenters—alert buyers are installing "Hallowell" Benches!

And here are good reasons for so doing: For by ordering "Hallowell" Benches, you get just the style or model you need in less time and at less trouble and cost than it takes to build one . . . and you get a better bench in the bargain!

"Hallowell" Benches bring you the advantages of permanently smooth, wear-free tops . . . lasting rigidity . . . easy movability which permits flexible shop arrangements. And they're easy to keep clean, can't soak up oil or eventually splinter into kindling as will wood benches.

More than 1300 styles and models, with attractive laminated wood, or combination tops if preferred for light work, are available from stock to meet your needs exactly and promptly. Write—or ask your distributor.

● *This handy, semi-portable model is a favorite because it goes right to the job . . . saves steps, time and money. Investigate for yourself!*

Fig. 992

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. Box 4
BRANCHES
BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO

P&H WELDING ELECTRODES

An All-Purpose Electrode With Higher Deposit Efficiency

Why spend time and money testing electrodes that have already won the approval of all the important testing bodies?

P&H "AP" electrodes — fully approved — are recommended for construction and maintenance of fired and unfired pressure vessels, ships, railroads, rolling stock, buildings, airplanes, pipe lines, heavy machinery, and steel structures. They can be used in all downhand, vertical and overhead positions. They are especially recommended where ultimate tensile strength, high yield point and elongation are necessary. Use them where low spatter loss and high deposit efficiency are desired.

"AP" is but one of the complete line of P&H welding electrodes developed to cover a wide variety of welding requirements. Write for full information.

P&H-HANSEN SQUARE FRAME WELDERS

Square frame design permits stacking of units one above the other for simple, parallel hook-up. With one unit, operator has welding current of from 15 to 200 amps.—or he can combine the capacities of two or more machines to handle peak loads.

This modern service eliminates the need for special, high amperage machines — cuts your investment in welding equipment. This small, but amazingly efficient machine retains — *and accentuates* — all the famous P&H-Hansen features, with single current control and unequalled arc performance. Ask for Bulletin W-28.

★ **AT THE METAL SHOW . . .**

Bring your welding problems to Booth No. E-20. A complete demonstration of P&H-Hansen Welders and P&H Welding Electrodes will be in continuous operation.

General Offices: 4514 West National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION

ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

WELD RIGHT WITH

Weltronic

TRADE MARK
REG. U.S. PAT. OFF.

There is a Weltronic Control for every known process of resistance welding ● Synchronous and non-synchronous Straight Time Timers ● Simple and accurate sequence Timers, single operation or automatic repeating ● Power tube and magnetic welding contactors ● Combinations, contactors and any sequence timer in one enclosure ● Know about Weltronic and know the best.

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2832 E. GRAND BLVD. DETROIT, MICHIGAN

Electric
and
Fuel Fired
Furnaces

ELECTRIC FURNACES FUEL FIRED

We Build
The Furnace
To Fit
The Job

Production Furnaces

For Forging, Annealing, Hardening, Brazing

or Any Other

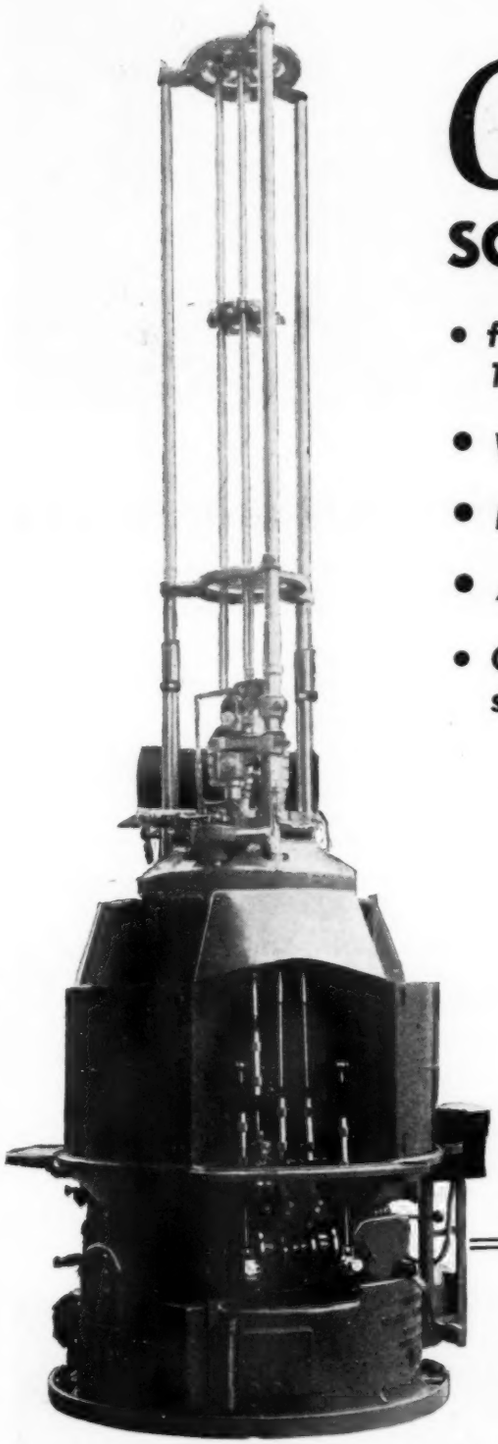
Heating or Treating Process

We build furnaces for any product, process or production. Our large and experienced engineering staff and ample manufacturing facilities enable us to make reasonably prompt deliveries.

We Solicit Your Furnace Inquiries.—Fuel Fired or Electric

The Electric Furnace Co., Salem, Ohio

A high production, simple, rigid machine designed for low cost, accurate production of SCREW MACHINE PARTS



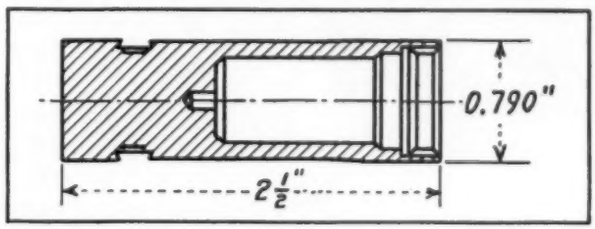
One machine can be shipped immediately from stock

GYROMATIC *automatic*

SCREW CUTTING MACHINE

- *for Bar Work . . . . . for Chuck Work*
  1" - 1⅝" - 2¼" 4" - 5½" - 7½"
- *Vertical Construction—less floor space*
- *Less Noise—Less Vibration*
- *Automatic Bar Feed—Automatic Indexing*
- *Great Accessibility — all tools visible, accessible and adjustable while cutting*

TYPICAL PRODUCTION ON THE GYROMATIC



Tensile Strength 130,000 lb. per sq. in.

PRODUCTION: 209 pieces per hr.

COSA

COSA OVERSEA TRADING CORPORATION

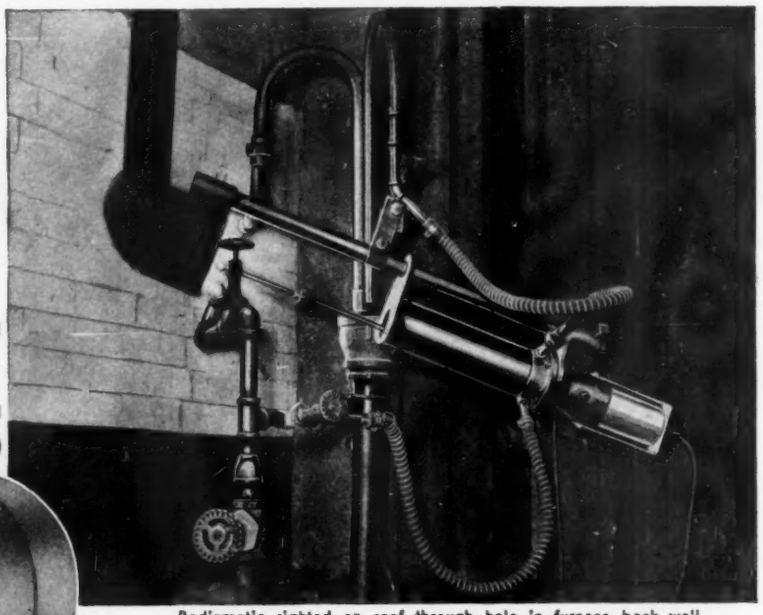
5000-04 CHRYSLER BLDG.

NEW YORK, N. Y.

Phone, Murray Hill 4-5365

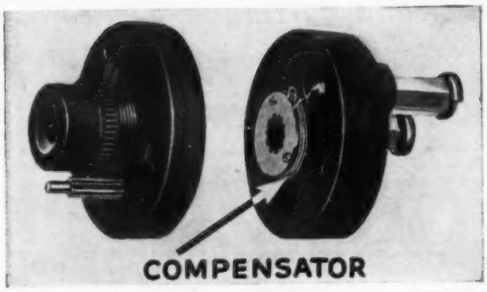
New RADIAMATIC

COMPENSATED *for* AMBIENT TEMPERATURES

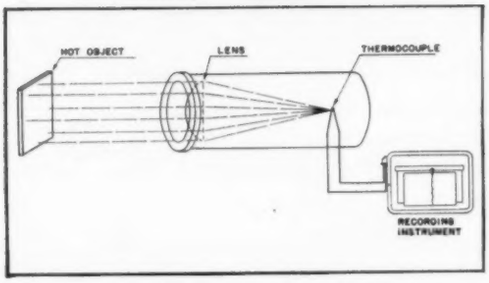


Radiamatic sighted on roof through hole in furnace back wall. Potentiometer continuously indicates and records roof temperature.

RADIAMATIC DETECTOR



COMPENSATOR



PRINCIPLE OF OPERATION

Brown Radiamatic will be on display at the National Metal Exposition, Cleveland, Ohio, Booth F4, October 21st. to 25th., 1940.

Satisfies All Demands

Convenient to operate and universal in applications for the measurement and control of temperatures where thermocouples are impractical and unreliable. The new Brown Radiamatic Pyrometer (Made in America) is designed to operate under severe conditions of temperature, vibration, etc.

Completely self-contained and compensated for ambient temperature errors, the Radiamatic detector is sighted on the hot object, moving or still, and continuously measures the desired temperature of the material itself.

The Radiamatic consists essentially of a heat-resisting lens, a compensator and a thermopile. The heat radiated from the hot object falls on the lens and is focused on the thermopile which generates an E.M.F. proportional to the true temperature. The compensator corrects for ambient temperature fluctuations surrounding the detector—hence the desired E.M.F. alone developed by the thermopile is translated into degrees of temperature and is continuously indicated, recorded or controlled by the potentiometer.

The Brown Radiamatic is ruggedly constructed, built to withstand vibration—accuracy is unaffected by dust, dirt, fumes and corrosive atmospheres. Easily installed complete with all accessories for mounting.

Use the Radiamatic for those applications where—vibration breaks thermocouples—furnaces move or rotate—work moves or thermocouples cannot be installed—temperature is above thermocouple range—furnace atmosphere conditions are unfavorable—maintenance of platinum thermocouples is costly.

For information write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4501 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street—Amsterdam-C, Holland: Wijdesteeg 4—England: Wadsworth Road, Perivale, Middlesex—Stockholm, Sweden: Nybrokajen 7.

BROWN RADIAMATIC PYROMETER

MANY GOOD THINGS are said . . .

The above casting (our Alloy No. 502) is used by a maker of heavy trucks to support the crankshaft while it's being carburized—to prevent warpage of the shaft. This heat-resisting Alloy No. 502 is having many good things said about it by its users. Evidently more than composition is needed to make a good alloy casting. That extra something is what we've learned in specializing on nickel-chromium alloys for 30 years. We not only know the metal, but we've also learned how to use it, in money-saving designs. If you're interested, we suggest you act promptly, because we're very busy. . . . Hoskins Manufacturing Company, Detroit, Michigan.

●

If you have an important and "fussy" heat-treating, or brazing job, it would pay you to investigate Hoskins Electric Furnaces. They are all equipped with durable, easy-to-renew Chromel elements; and are available in pot and box types in many sizes. Here, too, we suggest if you are interested, that you act now. Ask for Catalog 57.

●

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ELECTRIC HEAT TREATING FURNACES • • HEATING ELEMENT ALLOYS • • THERMOCOUPLE AND LEAD WIRE • • PYROMETERS • • WELDING WIRE • • HEAT RESISTANT CASTINGS • • ENAMELING FIXTURES • • SPARK PLUG ELECTRODE WIRE • • SPECIAL ALLOYS OF NICKEL • • PROTECTION TUBES

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PLASTICS HEADQUARTERS

DIRECTORY OF CONTRACT WORK FACILITIES

On this and the following 5 pages AMERICAN MACHINIST publishes the names of companies with specialized facilities for handling contract work and engineering. Designed to be of service to manufacturers during the coming active months, this directory includes as many listings as space permits. We will be pleased to learn of additional facilities. Address Contract Work Department, AMERICAN MACHINIST, 330 West 42d St., New York City.

CASTINGS

The American Brake Shoe & Foundry Co., New York City, (Meehanite)
American Laundry Machy. Co., Rochester, N. Y., (Meehanite)
Atlas Foundry Co., Detroit. (Meehanite)
Banner Iron Works, St. Louis, Mo., (Meehanite)
Barnett Foundry & Machine Co., Irvington, N. J., (Meehanite)
Bickneli-Thomas Co., Greenfield, Mass.
H. W. Butterworth & Sons Co., Bethayres, Pa., (Meehanite)
Catskill Metal Works, Inc., Catskill, N. Y.
The Challenge Machinery Co., Grand Haven, Mich.
Chase Brass & Copper Co., 40 Roland St., Waterbury, Conn.
The Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, O. (Meehanite)
Columbia Iron Foundry, 1631 North 5th St., Philadelphia, Pa.
The Conn. Malleable Castings Co., East & Bridge Sts., New Haven, Conn. (Malleable)
Cooper Alloy Foundry Co., 130 Broadway, Elizabeth, N. J. (Stainless, Monel, Nickel)
Cooper-Bessemer Corporation, Mt. Vernon, O. & Grove City, Pa. (Meehanite)
Cramp Brass & Iron Foundries Co., Philadelphia, Pa. (Iron & Bronze)
Delta-Star Electric Co., 2400 Block, Fulton St., Chicago
Benjamin Eastwood Corp., 300 Straight Street, Paterson, N. J. (Grey-Iron)
Ellison Brouze Co. Inc., Jamestown, N. Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn. (Iron and Steel—Meehanite)
Fleming Foundry Co., Springfield, Mass. (Meehanite)
Florence Pipe Foundry & Machine Co., Philadelphia, Pa. (Meehanite)
Flynn & Emrich Co., 301 Holliday Ave., Baltimore, Md.
Fulton Foundry & Machine Co., Cleveland, O. (Meehanite)
General Foundry & Mfg. Co., Flint, Mich. (Meehanite)
General Pattern Works, 2231 Buck St., Cincinnati, O.
Greenlee Foundry Co., Chicago Ill. (Meehanite)
Hamilton Foundry & Machine Co., Hamilton, O. (Mechanite)
Hershey Machine & Foundry Co., Manheim, Pa.
R. Hoe & Co. Inc., 910 E. 138th St., New York City (Grey Iron, Semi-Steel)
Hurley Machine Co., 1945 So. 54th Ave., Chicago (Grey Iron)
Kanawha Mfg. Co., Charleston, West Va. (Meehanite)
Key Co., East St. Louis, Ill. (Carbon & Alloy Steel)
Kinite Corp., Foote of Park Place, Milwaukee, Wis.
Kinney Iron Works, Los Angeles, Cal. (Meehanite)
Kline Hardware Co., Allentown, Pa.
Koehring Co., Milwaukee, Wis. (Meehanite)
Lake Erie Engineering Corp., Buffalo, N. Y.
Lane Manufacturing Co., Montpelier, Vt.
Lewistown Foundry & Machine Co., Lewistown, Pa.
E. Long, Ltd., Orillia, Canada (Meehanite)
Malleable Iron Fittings Co., Branford, Conn.
Meadville Malleable Iron Co., Meadville, Pa.
Meehanite Metal Corp., Pittsburgh, Pa. (Meehanite)
Mount Vernon Die Casting Corp., South & Pearl Streets, Mount Vernon, N. Y.
Mueller Brass Co., Riggin & Charles Sts., Port Huron, Mich.
National Erie Corp., Erie, Pa.
North Wales Machine Co., Inc., North Wales, Montgomery County, Pa.
Ohio Foundry Co., 98 Quincy Avenue, Cleveland, O.
Oliver Machinery Co., 1001 Coldbrook St., Grand Rapids, Mich. (Grey Iron, Semi-Steel, Machinery)
Peoria Malleable Castings Co., Peoria, Ill.
The Henry Perkins Co., Bridgewater, Mass. (Meehanite)
Pettibone Mulliken Corp., 4710 Division St., Chicago
Pollman Foundry Co., Inc., Buffalo, N. Y. (Meehanite)
The Prescott Company, Menominee, Mich. (Grey Iron)
Reliance Steel Casting Co., 28th & Smallman Sts., Pittsburgh, Pa.
Rosedale Foundry & Machine Co., Pittsburgh, Pa. (Meehanite)
Ross-Meehan Foundries, Chattanooga, Tenn. (Meehanite)
Service Machine Co., 756 Broadway, Elizabeth, N. J.
C. W. Shumway & Sons, Batavia, Ill.
I. S. Spencer's Sons, Inc., Guilford, Conn.
Sprout, Waldron & Co., 1400 Sherman St., Muncy, Pa.
Standard Steel Works Div., The Baldwin Locomotive Works, Philadelphia, Pa. (Steel)
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns-Roger Mfg. Co., Denver, Col. (Meehanite)
Straight Line Foundry & Machine Corp., 220 S. Geddes St., Syracuse, N. Y.
Stricker-Brunhuber Corp., 19 West 24th St., New York City (Grey Iron, Brass, Bronze, Aluminum)
Treadwell Engineering Co., Easton, Pa.
Valley Iron Works, St. Paul, Minn. (Meehanite)
The Vilter Mfg. Co., 2130 So. First St., Milwaukee
Vulcan Foundry Company, Oakland, Cal. (Meehanite)
Warren Foundry & Pipe Corp., Phillipsburg, N. J. (Meehanite)
Wilcox, Crittenden & Co., Inc., 33 So. Main St., Middletown, Conn.

DIE CASTINGS

Cleveland Hardware and Forging Co., 3262 East 79th St., Cleveland, O.
Doehler Die Casting Co., Batavia, Ill.
Dollin Corp., 600 So. 21st St., Irvington, N. J.
Imperial Die Casting Co., 2850 W. Fulton St., Chicago
Parker White-Metal & Machine Co., Erie, Pa.
Precision Castings Co., Inc., 12600 Berea Rd., Cleveland, O.
Production Tool & Die Co., 562 St. James Ave., Springfield, Mass.
E. Toman & Co., 2621 W. 21st Place, Chicago, Ill.
Parker White-Metal & Machine Co., Erie, Pa.

DIE COATING

St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y.

FINISHING

American Shearer Mfg. Co., Nashua, N. H. (Plating)
Delta-Star Electric Co., 2400 Block, Fulton St., Chicago (Hot dip galvanizing)
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa. (Hot dip galvanizing)
Knight Plating Co., 3143-5 Bellevue Ave., Detroit, Mich. (Electro-plating)
Metal Electric Processing Co., 1925 Nebraska Ave., Toledo, O. (Electric brazing)
Oliver Machinery Co., 1001 Coldbrook St., Grand Rapids, Mich. (Parkerizing & Bonderizing)
Philadelphia Rust-Proof Co., 3229 Frankford Ave., Philadelphia, Pa. (Annodizing, Parkerizing, Bonderizing, Sherardizing)

FORGINGS

American Hollow Boring Co., 1912 Raspberry St., Erie, Pa.
Atlas Drop Forge Co., Mt. Hope Ave., W. Lansing, Mich.
Bay City Forge Co., Erie, Pa.
The Billings & Spencer Co., 1 Laurel St., Hartford, Conn.
The Canton Drop Forging & Mfg. Co., Canton, O.
Canton Forge & Axle Works, 2025 Dueber Ave., S.W., Canton, O.
Champion Machine & Forging Co., 2695 East 78th St., Cleveland, O.
Chase Brass & Copper Co., 40 Roland St., Waterbury, Conn.
The Cleveland Hardware & Forging Co., 3262 East 79th St., Cleveland, O.
Cornell Forge Co., W. 74 St. & Ashland Ave., Chicago

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Harvey Metal Corp., 74th Street & Ashland Ave., Chicago, Ill.
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Lincoln Forging Co., 620 St. Antoine, Detroit, Mich. (Brass & Copper)
Marion Machine Fdry. & Supply Co., Marion, Ind.
Mondie Forge Co., 10300 Berea Rd., Cleveland, O.
Mueller Brass Co., Riggin & Charles Sts., Port Huron, Mich.
Norris Bros., Inc., Robinson, Ill.
Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland, O.
Rockford Drop Forge Co., 2030 9th St., Rockford, Ill.
Seamless Products Co., Inc., 113 W. 42nd St., New York City
Standard Steel Works Div., Baldwin Locomotive Works, Philadelphia, Pa.
Transue & Williams Steel Forging Corp., Alliance, O.
Warren Tool Corp., Warren, O.
The D. Wilcox Mfg. Co., Mechanicsburg, Pa.
J. H. Williams & Co., Buffalo, N. Y.

GENERAL MACHINING

Accurate Mfg. Co., 1711 W. 74th St., Chicago
American Shearer Mfg. Co., Nashua, N. H. (Light)
Apex Tool & Machine Co., 921 S. Cicero Ave., Chicago
Auto Soler Co., 526 Stonewall St., S.W., Atlanta, Georgia
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa. (Large castings)
Brook Machine Shop, 303 W. Union Ave., Bound Brook, N. J.
Carver Cotton Gin Co., East Bridgewater, Mass.
Catskill Metal Works, Inc., Catskill, N. Y.
Chapman Transmission Corp., 1053 Military Rd., Buffalo, N. Y.
Chicago Gear Mfg. Co., 2823 W. Fulton St., Chicago
Denning Mfg. Co., 1775-1781 East 87th St., Cleveland, O.
Erie Malleable Iron Co., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Frank Gradischnig Co., P. O. Box 213, Ambridge, Pa. (Small)
The Greist Mfg. Co., 546 Blake St., New Haven, Conn.
Otto U. Hofman, 3rd & Cayuga Sts., Philadelphia, Pa.
Kamis Engineering Co., 3d & Moore St., Philadelphia, Pa.
Lempco Products Inc., Bedford, O.
Lenney Machine & Mfg. Company, Warren, O.
Malleable Iron Fittings Co., Branford, Conn.
Marion Machine Fdy. & Supply Co., Marion, Ind.
Midwest Machine Co., 2826 Walnut St., Chicago
Murray Company, Carver Div., East Bridgewater, Mass. (Castings, Parts)
Pettibone Mulliken Corp., 4710 W. Division St., Chicago (Heavy)
Charles E. Reed & Co., 3227 Carroll Ave., Chicago
Robey Mfg. Co., 1937 Harvey St., East Lansing, Mich. (Forgings)
Sal Metal Products Co., 26 Bleecker St., New York City
Straight Line Foundry & Machine Co., 220 S. Geddes St., Syracuse, N. Y.
Stricker-Brunhuber Corp., 19 West 24th St., New York City
Trumbull Mfg. Company, Warren, O.
Vilter Mfg. Co., 2130 So. First St., Milwaukee
Wayne Mfg. Co., Honesdale, Pa.

GRINDING

A-1 Screw Machine Products Corp., Chicago (Cylindrical, Horizontal)
Ace Hardware Mfg. Corp., 2017 E. Orleans St., Philadelphia, Pa. (Centerless)
American Shearer Mfg. Co., Nashua, N. H. (also Polishing and Buffing)
Bergram Mechanical Engin. Co., Inc., New Britain, Conn.
Bunell Machine & Tool Co., 1600 E. 24th, Cleveland, O.
Chowning Regulator Corp., Corning, N. Y.
Cincinnati Ice Pick & Tong Mfg. Co., 118 Burrows St., Cincinnati, O.
Commercial Centerless Grinding Co., 6538 Carnegie Ave., Cleveland, O. (Centerless)
Eastern Centerless Grinding Co., 624 Capitol Ave., Hartford, Conn.
General Machine Works, 515 Prospect St., York, Pa.
Hartford Machine Screw Corp., 476 Capitol Ave., Hartford, Conn.
Hartford Special Machy. Co., Hartford, Conn. (Gears, Threads, Cams)
The Heim Co., 46 Sanford St., Fairfield, Conn.
Industrial Centerless Grinding Co., 14640 Schaefer Rd., Detroit, Mich.
Carlyle Johnson Machine Co., Manchester, Conn.
John W. Leahy, 130 White St., Danbury, Conn.
Lempco Products Inc., Bedford, O.
Machinists Tool Grinding Co., 2834 West Lake St., Chicago, Ill.
Mergenthaler Linotype Co., 29 Ryerson St., Brooklyn, N. Y.
Monrad Engineering Co., Portsmouth, O.
North End Machine Co., 388-92 Newell St., Barberton, O. (Cylindrical)
Ohio Knife Co., Cincinnati, O.
Peters Tool Co., 114 E. Scott St., Milwaukee
Pettibone Mulliken Corp., 4710 W. Division St., Chicago (Heavy)
Phonograph Needle Mfg. Co., 42-46 Dudley St., Providence, R. I. (Pins & Needles)
Porter Machine Co., 3120 Forrer Ave., Cincinnati
Service Machine Co., 756 Broadway, Elizabeth, N. J.
Special Hinge & Mfg. Co., 1682 East 55th St., Cleveland, O.
Sprout, Waldron & Co., 1400 Sherman St., Muncy, Pa.
Taylor Machine Co., 1919 E. 61st St., Cleveland
Wayne Mfg. Co., Honesdale, Pa. (Cylindrical)
Western Machine Co., Milwaukee, Wis. (Centerless, Integral, Cylindrical)

HEAT-TREATING

Accurate Steel Treating Co., Chicago, Ill.
Acme Steel Treating Co., Detroit, Mich.
American Metal Treatment Co., Elizabeth, N. J.
American Shearer Mfg. Co., Nassau, N. H.
The Auto Soler Co., 526 Stonewall St., S.W., Atlanta, Georgia
The Bennett Metal Treating Co., Elmwood, Conn.
Blue Blade Heat Treating Co., 360 Jeliff Avenue, Newark, N. J. (Strip steel only)
Chowning Regulator Corp., Corning, N. Y.
Collins Supply & Equipment Co., 1355 Monsey Ave., Scranton, Pa.
Commonwealth Heat Treating Co., Detroit, Mich.
H. C. Cook Co., 20 Beaver St., Ansonia, Conn.
Cook Heat Treating Corp., Los Angeles, Cal.
The Dayton Forging & Heat Treating Co., Dayton, O.
The G. M. Diehl Machine Works, Inc., Wabash, Ind. (by electric salt bath equipment)
General Machine Works, 515 Prospect St., York, Pa.
Hartford Machine Screw Corp., 476 Capitol Ave., Hartford, Conn.
Heinzelman's Heat Treating Service, 154 Spring St., New York City
R. Hoe & Co., Inc., 910 E. 138th St., New York City
Industrial Centerless Grinding Co., 14640 Schaefer Rd., Detroit, Mich.
Industrial Steel Treating Co., Oakland, Cal.
Lakeside Steel Improvement Co., 5418 Lakeside Ave., Cleveland, O.
Lindberg Steel Treating Co., Chicago, Ill.
Metlab Co., 1000 Mermaid Lane, Philadelphia, Pa.
O. T. Muehlemeyer Heat Treating Co., Rockford, Ill.
New England Metallurgical Corp., Boston, Mass.
Norfolk Hardening Works, Inc., Boston, Mass.
The Ohio Heat Treating Co., Dayton, O.
Ohio Knife Co., Cincinnati, O.
Perfection Tool & Metal Heat Treating Co., Chicago, Ill.
Pittsburgh Commercial Heat Treating Co., Pittsburgh, Pa.
Porter Steel Treating Co., Geo. H., 1265 E. 55th, Cleveland, O.
Porter Forge & Furnace, Inc., Everett, Mass.
Porter Machine Co., 3120 Forrer Ave., Cincinnati
Queen City Steel Treating Co., Cincinnati, O.
Stanley P. Rockwell Co., Hartford, Conn.
C. U. Scott & Son, Rock Island, Ill.
Fred A. Snow Co., Chicago, Ill.
Syracuse Heat Treating Co., 227 Solar St., Syracuse, N. Y.
Thurner Heat Treating Co., 809 W. National Ave., Milwaukee, Wis.
United Shank & Findings Co., Whitman, Mass.
Wesley Steel Treating Co., Milwaukee, Wis.
Wiedemann Machine Co., Philadelphia, Pa.
Robert Wooler, Philadelphia, Pa.

DIRECTORY OF CONTRACT WORK FACILITIES

MACHINE FRAMES, Welded
General Machinery Corp., Hamilton, O.
George Koch Sons, Inc., Evansville, Indiana
Kirk & Blum Mfg. Co., 2833 Spring Grove Ave., Cincinnati, O.
Lewis Welding & Engineering Co., 881 Addison Road, Cleveland, Ohio
The R. C. Mahon Company, Detroit, Michigan

PATTERNS
Bedford Aluminum Specialty Co., 33 Walker Street, New York City
General Pattern Works, 2233 Buck St., Cincinnati
Straight Line Foundry & Machine Corp., 220 S. Geddes St., Syracuse, N. Y.
Stricker-Brunhuber Corp., 19 West 24th St., New York City (Metal & Wood)
York Pattern Works, York, Pa. (Wood)

PLASTICS, Laminated & Molded
American Insulator Corp., New Freedom, Pa.
Auburn Button Works, Inc., Auburn, N. Y.
American Phenolic Corp., 1250 W. Van Buren St., Chicago, Ill.
Baldwin Labs., Inc., Franklin, Pa.
Boonton Molding Co., Boonton, N. J.
Cardinal Corp., Evansville, Ind.
Chicago Molded Products Corp., 1020 N. Kolmar Street, Chicago, Ill.
Consolidated Molded Products Corp., 1940 Thomas Street, Scranton, Pa.
Continental Diamond Fibre Company, Newark, Del.
Diemolding Corp., Canastota, N. Y.
Erie Resistor Corp., Erie, Pa.
Eclipse Moulded Products Co., 5135 N. 32nd St., Milwaukee, Wis.
Formica Insulation Co., 4672 Spring Grove Ave., Cincinnati, O.
General Electric Co., 1 Plastics Ave., Pittsfield, Mass.
General Industries Co., Elyria, O.
Firestone Tire & Rubber Co., Plastics Div., Akron, O.
Inland Mfg. Co., Dayton, O.
Gits Molding Corp., 4600 W. Huron St., Chicago
Kurz-Kasch Co., 1450 So. Broadway Ave., Dayton, O.
Mack Molding Co., Wayne, N. J.
Norton Laboratories, Inc. Lockport, N. Y.
Marblette Corporation, 37-21 Thirtieth St., Long Island City, N. Y.
Reynolds Spring Co., Plastics Div., Cambridge, O.
The Richardson Co., Lockland, Cincinnati, O.
Jos. Stokes Rubber Co., 322 Webster St., Trenton, N. J.
Universal Plastics Corp., 235 Jersey Ave., New Brunswick, N. J.
Waterbury Button Co., 39 River St., Waterbury, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Worcester Moulded Plastics Co., 9 Grafton St., Worcester, Mass.

PUNCHINGS
Continental Diamond Fibre Company, Newark, Delaware
Wayne Mfg. Co., Honesdale, Pa.

SCREW MACHINE PRODUCTS
A-1 Screw Machine Products Corp., Chicago
Ace Hardware Mfg. Corp., 2017 E. Orleans St., Philadelphia, Pa.
Akron Machine Mold Tool & Die Co., 1848 Front St., Cuyahoga Falls, O.
Ansonia Mfg. Co., 10 River Rd., Ansonia, Conn.
Apex Tool & Machine Co., 921 S. Cicero Ave., Chicago
The Auto Soler Co., 526 Stonewall St., S.W., Atlanta, Georgia
B & B Specialty Co., Madeira, O.
Bedford Aluminum Specialty Co., 33 Walker St., New York City
The David Bell Co., Inc., 1557 Fillmore Ave., Buffalo, N. Y.
Bicknell-Thomas Co., Greenfield, Mass.
Blake & Johnson Co., Waterville, Conn.
Brown-McClaren Mg. Co., 5879 West Fort St., Detroit, Mich.
Chase Brass & Copper Co., 40 Roland St., Waterbury, Conn.
Clark Brothers Bolt Co., Milldale, Conn.
Cleveland Screw Products Co., 3056 East 93d St., Cleveland, O.
Continental Diamond Fibre Co., Newark, Del.
The H. C. Cook Co., 20 Beaver St., Ansonia, Conn.
The Corbin Screw Corp., 1935 Baldwin St., New Britain, Conn.
Curtis Screw Co., Inc., 25 Gull St., Buffalo, N. Y.
Davis & Hemphill, Race Road, Elkridge, Md.
The Dill Mfg. Co., 687 E. 82nd St., Cleveland, O. (Brass)
Dinsmore & Jager, Northampton, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Dudley F. Fasoldt, Prospect Heights, Rensselaer, N. Y.
Fischer Special Mfg. Co., 2729 Morgan Street, Cincinnati, O.
General Engineering Works, 4705 W. Division Street, Chicago, Ill.
Grandahl Tool & Machine Co., 1200 Park St., Hartford, Conn. (Hand)
The Greist Mfg. Co., 546 Blake St., New Haven, Conn.
Hartford Machine Screw Corp., 476 Capitol Ave., Hartford, Conn.
Howe Machinery Co., 30 Gregory Ave., Passaic, N. J.
Humason Mfg. Co., Forestville, Conn.
Hurley Machine Co., 1945 S. 54th Ave., Chicago
Imperial Metal Products Co., Estimate Dept., Grand Rapids, Mich.
Imsande Screw Products Co., 3517 Cardiff Ave., Oakley, Cincinnati, O.
Jessen Mfg. Co., 1407 W. Beardsley Ave., Elkhart, Ind.
The Carlyle Johnson Machine Co., Manchester, Conn.
Key Co., East St. Louis, Ill.
Lempco Products, Inc., Bedford, O.
The Locke Machine Co., 972 E. 63d St., Cleveland
Machinery Products Corp., 2024 No. Major Ave., Chicago, Ill.
Mergenthaler Linotype Co., 29 Ryerson St., Brooklyn, N. Y.
Mid-West Screw Products Co., 20 St. George St., St. Louis, Mo.
Franklin S. Miles, 2422 N. Marscher St., Philadelphia, Pa.
The Milford Rivet & Machine Co., Post Road, Milford, Conn.
Milwaukee Screw Parts Co., 522 So. 2d St., Milwaukee
Mueller Brass Co., Riggin & Charles Sts., Port Huron, Mich.
National Brass Co., Grand Rapids, Mich.
National Sewing Machine Co., Belvidere, Ill.
New Britain Machine Co., New Britain, Conn.
Newton Mfg. Co., Plainville, Conn.
Norris Bros., Inc., Robinson, Ill.
Northwest Automatic Products Corp., 139 Holden St., Minneapolis, Minn.
Olson Mfg. Co., 53 Commercial St., Worcester, Mass.
Wm. H. Ottemiller Co., Pattison St., York, Pa.
Paramount Manufacturing Co., Hillsdale, Mich.
Parker & Harper Mfg. Co., 119 Parker St., Worcester, Mass.
The Peck Spring Co., Plainville, Conn.
Peco Mfg. Corp., Hope St. & Indiana Ave., Philadelphia, Pa.
Floyd Penrod & Son, 1216 W. 2d St., Muncie, Ind.
Robey Mfg. Co., 1937 Harvey St., East Lansing, Mich.
Rochester Machine Screw Co., 171 Clarissa St., Rochester, N. Y.
Sabin Machine Co., 6540 Carnegie Ave., S.E., Cleveland, O.
Schnitzer Alloy Products Co., 527 Broadway, Elizabeth, N. J.
Screw-Machine Products Co., 4051 South Iowa Ave., Milwaukee, Wis.
Selflock Screw Products Co., Manlius Street, East Syracuse, N. Y.
Service Machine Co., 756 Broadway, Elizabeth, N. J.
Samuel J. Shimer & Sons, Box 268, Milton, Pa.
I. S. Spencer's Sons, Inc., Guilford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
William Steinen Mfg. Co., 43 Bruen St., Newark, N. J.
Taylor Machine Co., 1919 E. 61st St., Cleveland, O.
Transue & Williams Steel Forging Corp., Alliance, O.
Wallace Metal Products Co., 53 Wallace St., New Haven, Conn.
Waltham Screw Co., Waltham, Mass.
Waltham Watch Co., Waltham, Mass.
Ware Brothers, 4449 W. Lake St., Chicago, Ill.
Waterbury Screw Machine Products Co., Cheshire Rd., Waterbury, Conn.
Wayne Mfg. Co., Honesdale, Pa.
Watkins Mfg. Co., 1938 Broad St., Milford, Conn.
The Wellman Products Co., 1434 East 49th St., Cleveland, O.
Western Machine Co., 121 N. Broadway, Milwaukee, Wis.

SPECIAL ENGINEERING
American Die & Tool Co., East Reading, Pa.
The Challenge Machinery Co., Grand Haven, Mich.
The Cimatool Company, Dayton, O.
Cleveland Metal Stamping Co., 3113 Payne Ave., Cleveland, O.
Continental Industrial Engineers, Inc., 201 N. Wells St., Chicago, Ill.
The Earle Gear & Machine Co., 4707 Stenton Ave., Philadelphia, Pa.
Robert Holmes & Bros., Inc., 1935 Kenneth Ave., Danville, Ill.
Howe Machinery Co., 30 Gregory Ave., Passaic, N. J.
Indian White Eagle Engineering Works, Foot of 18th St., Brooklyn, N. Y.
Kamis Engin. Co., 3d & Moore Sts., Philadelphia, Pa.
Kane & Roach, Inc., Syracuse, N. Y.
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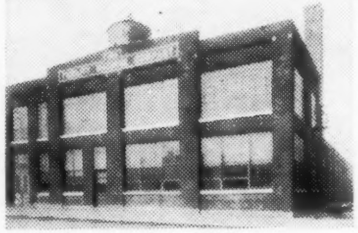

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700,000 sq. ft.

Reo Motor Inc. 1 of 3 Plants at Lansing, Michigan 2 Railroads — Sprinkler System Brick

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62,200 sq. ft.

2-Bldg's Midtown New York City 40,000 sq. ft. 22,200 sq. ft. Fireproof Sprinkler

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3-Bldg's 79,680 sq. ft. 18,472 sq. ft. 27,350 sq. ft. Fireproof 2nd & Norris Sts. Phila., Pa.

BROKER ‡ * PROPERTY ‡ 163

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52	Dwight, Voorhis & Hemlesey, Inc. 127 West 23 Street, New York City
53	Joseph P. Day, Inc. 405 Lexington Avenue, New York City
54	Thomas N. Scoville 103 East 29 Street, New York City
55	J. J. O'Conner, Organization 110 East 42nd Street, New York City
342	Paul Paulson of First Mortgage Securities Corp., 115 Penn Avenue, Brooklyn, N. Y.
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62,000 sq. ft.

5 story & bas't Sprinklered. For Sale or Lease. 389 Kent Avenue, S. E. Cor. Hewes St., Bkyln., N. Y.

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POSITIONS VACANT

ASSISTANT MECHANICAL SUPERINTENDENT in Machine Tool Room of large New England manufacturer. Must be broadly experienced mechanic qualified by experience, personality and leadership to assume responsibility. Address P-882, American Machinist, 330 W. 42nd St., New York, N. Y.

FOREMAN with wide experience wanted by Jobbing Shop located in the Middlewest, employing one hundred (100) men on high-grade jigs, fixtures, dies and special machinery. Must be capable of producing. Age, qualifications, previous employment, salary expected, in first letter. All replies will be kept confidential. P-883, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

AUTOMATIC SCREW MACHINE OPERATOR, wanted by Southwestern Michigan Manufacturer, not over 55 years of age. P-884, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

WANTED: Man to work in capacity of Assistant Superintendent in shop located in the Chicago manufacturing area building machine tools. To be qualified in methods of jigging and tooling production, scheduling, etc. Give references as to present and former employment, age, qualifications, salary expected. P-885, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

SCREW MACHINE FOREMAN Wanted by large manufacturing concern located in New England. Must be thoroughly familiar with single spindle Cleveland, Brown & Sharpe, Jones & Lamson Bar and hand machines. Only energetic men with passed experience as supervisor need apply. P-887, American Machinist, 330 W. 42nd St., New York, N. Y.

POSITIONS VACANT

EXPERIENCED HYDRAULIC SERVICE MAN wanted capable of analyzing and servicing modern Hydraulic press equipment. P-888, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

(See also "Selling Opportunities Wanted")

ENGINEER 40 familiar ordnance-ammunition application desires connection with small office or engineer for exploitation of this knowledge. Foreign born but citizenship applied for. PW-877, American Machinist, 330 W. 42nd St., New York, N. Y.

FOREMAN-DIE MAKER 30 years experience 10 as Foreman Die Castings Dies Bakelite Molds also stamping dies and fixtures. Can do own hardening and drawings. Familiar all types machinery Western locality preferred. PW-878, American Machinist, 330 W. 42nd St., New York, N. Y.

HIGHLY SKILLED TOOL ENGINEER, well experienced in the manufacture of firearms, ammunition, punch and die work, and B.&S. screw machine work, seeks new connection. American, age 44, Metropolitan or New England area preferred. PW-886, American Machinist, 330 W. 42nd St., New York, N. Y.

DESIGN, Development, Research, Standardizing, Checking, Testing, Manufacturing of Tools, Dies, Jigs, Fixtures, Machine Tools, Tube Specialties, Massproduction-Parts; 9 years experience; Grad. M.E.; desires change. PW-880, American Machinist, 330 W. 42nd St., New York, N. Y.

Wanted

MACHINE TOOL MANAGER

Experienced in purchasing and selling of used and rebuilt machinery—New York City office.

Only application by man who can show real accomplishment and thorough knowledge of field will be considered.

P-876, American Machinist
330 W. 42 St., New York City

POSITIONS WANTED

GENERAL ASSISTANT: Twenty years diversified construction and plant engineering: Job planning, maintenance and installations, perpetual plant valuation, background production studies. PW-890, American Machinist, 330 W. 42nd St., New York, N. Y.

DRAFTSMAN designer automatic machinery, paper converting, handling, 24 years experience, location New York City. PW-891, American Machinist, 330 W. 42nd St., New York, N. Y.

ADDITIONAL EMPLOYMENT, BUSINESS & SELLING OPPORTUNITIES ADVERTISING on Page 176

EMCO REBUILT MACHINE TOOLS

ENGINE LATHES

14"x6' Hendey, cone
14"x6' Prentice Geared Head
14"x8' American, cone
14"x10' Lodge & Shipley Selec. Hd.
15"x8' LeBlond, cone
15"x8' Sidney, cone
16"x6' LeBlond, cone
16"x6' Greaves-Klusman, cone
16"x7' Pratt & Whitney, cone, taper
16"x8' American, cone
16"x12' American, cone
16"x8' Monarch, cone
16"x8' Rockford, cone
18"x6' Monarch, cone
18"x8' Hendey, cone
18"x8' LeBlond, cone
18"x8' Lodge & Shipley Selec. Hd.
18"x8' Mueller, cone
18"x10' Schumacher-Boye, cone
20"x8' American, cone
21"x8' LeBlond, cone, taper
21"x10' LeBlond, cone
24"x10' Bridgeford, cone
24"x12' American, cone
24"x16' Schumacher-Boye, cone
24"x18' Lodge & Shipley Patent Head
26"x12' Boye & Emmes, cone
27"x16' Bridgeford, cone
42"x24' Springfield, cone
42" raised to 53"x39' Putnam, d.c. drive

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Niles-Bement-Pond No. 5 Car Wheel Lathe, brand new
Niles-Bement-Pond Quartering Machine, brand new
15"x6' Automatic Threading Lathe, cone
17"x6' LeBlond Rapid Production Lathe, cone
18"x8' Chard Mfg. Lathe, cone
20"x8' American Turret Lathe, cone
22"x5' Monarch Geared Head Mfg. Lathe, m.d. in base

HAMMERS

4000 lb. Niles-Bement-Pond Double Frame Steam, brand new
650 lb. American No. 410 Steam
550 lb. Bement-Niles Single Frame Steam
4—350 lb. Niles-Bement-Pond Steam, brand new
250 lb. Little Giant, belt
200 lb. Bradley Upright, Strap
100 lb. Little Giant, belt
100 lb. Bates, m.d., new

MILLING MACHINES

No. 3 Ohio Universal, cone
No. 2A, 4B, 5C, 6 Becker Vertical, cone
No. 22 Garvin Vertical
No. 2H Brown & Sharpe Plain, cone
No. 2 Van Norman Duplex, belt
No. 3 Kempsmith Plain, cone
No. 4 Cincinnati Plain, cone
No. 13B Brown & Sharpe Plain, s.p.d.
No. 15 Garvin Plain, cone
No. 25 Becker Plain, cone
48" Cincinnati Plain Automatic, s.p.d.
24" Cincinnati Plain Automatic, s.p.d.
24" Cincinnati Duplex Automatic, belt
Gooley & Edlund, Putnam, and Garvin, Briggs Type
36"x36"x8' Ingersoll Combined Vertical and Horizontal, belt
48" Oesterlein Tilted Offset, m.d., Timken Bearings
C66A Newton 3 spindle Continuous
No. 6 Whitney Hand, belt

GRINDERS

No. 50, 55, 60, 65 Heald Cylinder
6x18" Landis Plain Cylindrical, m.d.
6x32" Norton Plain Cylindrical, m.d.
No. 14 Brown & Sharpe Plain Cylindrical, belt
10x36" Landis Plain, m.d.
10x36" Norton Plain, m.d.
10x50" Norton Plain, m.d.
10x52" Landis Plain, m.d.
10x72" Landis Plain, m.d.
12x18" Cincinnati Plunge Cut, m.d.
12x72" Landis Plain, m.d.
14x72" Norton Plain, m.d.
16x48" Cincinnati Plain, belt
16x52" Landis Plain, m.d.
16x72" Landis Plain, m.d.
20x144" Landis Plain, m.d.
No. 1, 4, 6 Gardner Disc, m.d.
No. 20 Gardner Combination, m.d.
No. 51 Besly Disc, m.d.
No. 120 Gardner Disc, belt
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No. 6 Bryant Semi Automatic Hole, belt
No. 10 Bryant Semi-Automatic Hole, belt
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24"x12' Monarch G.H. M.D.
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#4B Milwaukee Double over arm motor drive
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#4 Cincinnati High Power, Universal
#2 Kempsmith Plain Cone Drive
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#34 Van Norman
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#1 Springfield Gage Grinder

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#3 Gardner Polishing Lathe — 16x6 Wallcott

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4' Western, Motor on Column
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7', 8' Western Heavy

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14"x96" Norton Face
No. 22-12" Heald Rotary Surface
No. 25—16" Heald Hyd. Rotary Surface
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No. 16-A Blanchard Auto. Vertical Surface

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16"x8' Lodge & Shipley, Taper Attachment
16"x8' Lodge & Shipley
18"x12' American Geared Head
20"x10', 12' Lodge & Shipley Grd. Hd.
20"—40"x10' Rahn-Larmon Geared Head Sliding Bed Gap
24"x12' American
24"x18' American Geared Head
24"x22' Lodge & Shipley, taper attachment
27"x18' American Geared Head, taper Att.
30"x12' Lodge & Shipley Grd. Hd.
36"x16' American, Taper
36"x21' American Grd. Hd., Triple Grd.
36"x24' Bradford Triple Geared, Taper Att.
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60" New Haven Turning & Boring

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No. 2 Brown & Sharpe, Plain
No. 3 Kempsmith, Plain
No. 2 Cincinnati Universal
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24" Cincinnati, Duplex
No. 3 Garvin Duplex
No. 4 Hendey Mfg.
Type "B" Briggs Mfg.
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2—16" Gould & Eberhardt—M.D.

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1—36"x22' Bridgeford—G. Head
1—36"x15' Putnam—Geared Head
1—36"x14' NBP—Geared Head
1—30"x13'6" NBP—Geared Head
2—28"x14'6" Lodge & Shipley—G.H.
1—27"x12'6" Greaves—Geared Head
1—24"x10' Prentice—Geared Head
1—20"x14' Walcott—Geared Head
1—20"x12' Lodge & Shipley—M.D.
1—20"x10' American—Motor Drive
1—20"x10' LeBlond—Geared Head
6—18"x8' Prentice—Geared Head
5—16"x8' Prentice—Geared Head
1—16"x8' Monarch—Geared Head
1—14"x10' Hendey—Geared Head
3—10"x5' P.&W. Prod. Lathes

Millers

1—37"x37"x14' Ingersoll—Adj. Rail
1—32"x24"x8' Ingersoll—Adj. Rail
2—8" Spindle Ingersoll Facing Machs.
2—#5C Brown & Sharpe Vert. Millers
1—#AB Becker Vertical Miller
1—#4 Hendey Plain Miller
2—#1½B Brown & Sharpe Plain
2—#1B Brown & Sharpe Plain
1—#3A Brown & Sharpe Universal
2—#2A Brown & Sharpe Universal
1—#1A Milwaukee Plain
1—#1B Milwaukee Plain
1—#3 Garvin Duplex—Motor Drive

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Performance and accuracy of our Rebuilt Machines are unconditionally guaranteed

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60"x48"x16' — MODERN DESIGN — LIKE NEW IN EVERY RESPECT — IMMEDIATE DELIVERY

Because our customer desired a still larger Liberty Planer, we have available for immediate delivery this fine 60"x48"x16' Double Housing Planer which has seen only a few months of actual service. Completely gone over by us it is now equivalent to a new planer in every way.

Rapid traverse to all heads—Electrical rail clamp—Forged steel rack—Side head has in feed—Timken bearings in bed—Forced feed lubrication

Arranged for AC or DC motor drive—20 to 35 HP

THIS MACHINE COULD BE LENGTHENED TO AN OVERALL TABLE LENGTH OF 28 FEET AT SMALL ADDITIONAL EXPENSE AND WITH A 60 DAY DELIVERY.

Distance between housings	61"
Maximum distance under cross rail	49"
Length of table between pockets	16'–0"
Overall width of machine	14'–6"
Overall length of bed	23'–0"
Total height of machine	9'–7"
Width of table	52"
Horse power of driving motor	20 HP

You are invited to inspect this planer at our plant

LIBERTY PLANER & MFG. CO.
HAMILTON, OHIO

PRICED VERY LOW
For Immediate Delivery

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3—SPENCER 9000 CFM TURBO
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1—G. E. 5900 CFM
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Lathe 14" swing Monarch
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PITTSBURGH, PA.

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20"x10' Davis Lathe, plain change gear
Nos. 4 & 5 Madison-Kipp Die Cast. Machs.

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36"x36"x12' Cleveland Openside Planer, 3 Hds.
36"x30' Pittsburgh Grd. Head Lathe, Q.C.G.
Horiz. Mill, 3" bar Rochester, Table Type, M.D.
Post Mill, 6½" bar Niles, R.P.T., M.D.
62" Bullard Vert. Boring Mill, 2 heads, M.D.
6' American Triple Purpose Radial Drill, M.D.

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28th Street & A.V.R.R. Pittsburgh, Pa.

Lathes, American 22"x14'. Quick change cone drive, taper attach. Warner & Swasey 14" turret.
Shaper, 16" American, cone drive, like new.
Punch & Shear, single end, 24" throat. Capacity 1" through 1". Shear 1"x6".
Slotter, 12" stroke, revolving table.
Sirene, Federal, 3-60-220. **Wheel Press,** 200 ton.
Hack Saws; Air Compressors.
Milling Machine, #5-C Becker-Brainard, cone dr.
Motors, AC & DC, up to 150 H.P.
Transformers; Electric Locomotives.
GUYAN MACHINERY CO., Logan, West Va.

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Shapers **Lathes**
Drill Presses **Planers**
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14x6 Rockford; Q.C.G. cone
14x6 Hendey; tie bar; cone
14x6 Hendey Geared Head
14x8 LeBlond Toolroom; cone
14x6 LeBlond Geared Head
14x6 LeBlond Rapid Production
14x6 LeBlond Toolroom; taper; Q.C.G.
19x8 LeBlond; heavy Duty; cone; production
14x6 LeBlond toolroom; taper; Q.C.G.
14x6 Lodge & Shipley Geared Head; M.D.
16x6 South Bend; cone
16x6 Hendey; Taper; Tie-Bar; Q.C.G.
16x6 Hendey; Tie-Bar; Q.C.G.
16x6 Monarch Q.C.G. cone; collets
16x8 Cincinnati; taper; cone
16x8 American Q.C.G. cone
16x8 South Bend; cone
16x8 Cincinnati; cone
17x8 Sidney Q.C.G. cone
18x8 Mueller; Q.C.G. cone
18x8 Cisco Q.C.G. cone
18x8 Flather Q.C.G. cone
18x8 Mueller; Q.C.G. cone
20x8 American Geared Head
32x14 Boye & Emmes Q.C.G. cone; Taper
24x12 Crawford Q.C.G. cone
24"x16' Lodge & Shipley, Cone Motor Dr.
42" x 18' GLEASON, Heavy, Cone

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24" Cin-Bickford Gear Box Drive
36" Snyder
30" Snyder
28" Davis
24" Rockford
20" Barnes, Rockford, Davis
#2 Colburn
18" Buffalo Forge Co., M.D.
15" Buffalo Forge Co.; M.D.

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Cleveland 1½" Model A; M.D.
Gridley ¾" Model F; 4-spindle
Fay 14"x19"

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#3 Cincinnati Standard Plain, Cone;
#3 Kempsmith Plain, Cone, (2)
#3 OHIO Plain, Cone;
#2 Kempsmith, Plain, Cone
#1½ Cincinnati Universal, Cone;
#2 Van Norman Universal Duplex; cone; (2)
#1¼ Rockford Plain, Cone;
#1 Kempsmith Plain cone (5)
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#1½ Brown & Sharpe, Plain, Cone, Index Heads
#2 CINCINNATI VERTICAL MILLER, cone
#6 JACKSON Vertical Miller with Cherry
#5C BECKER Vertical, MD
#5B BECKER Vertical, cone (2)
#3 BECKER Vertical, cone
#2 Becker Vertical, Cone
#½ Van Norman Univer. Duplex (4)
#0 Van Norman Univ. Duplex
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#5 HENDEY Lincoln QCG (2)
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#13 Pratt & Whitney Lincoln
#3 Gooley & Edlund Briggs
#6 Whitney Hand (10)
#0 Brown & Sharpe
#1 U. S. Eng. Hand
#1—AUERBACH, Hand
#3—BURKE, Hand, Pedestal (3)
Van Norman, Bench, Hand
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6' Niles-Bement-Pond Universal
4' Cincinnati-Bickford
4' Bickford
4' Niles Semi-Universal
4' Dreses—Flat Column
3½' Silver
3' Fosdick; late type
3' Bickford
3' Dreses
3' American
2½' Fosdick; late type
2½' Dreses, simplex
3' Carlton; B.B. Sensitive; M.D.

TURRET LATHES & SCREW MACHINES

(3) #1 Warner & Swasey, wire feed
#4 Warner & Swasey, GFH, Bar feed
#4 Cincinnati-Acme, GFH, Bar feed, 1½"
#2 Acme Hand Screw Machine 1" cap.
#2 Warner & Swasey Hand Screw Machine, 1" cap.
#1½ Garvin Hand Screw Machine 1¼" cap. (2)
#4 Warner & Swasey Universal Turret Lathe, 1½" Barfeed, Geared Head
#2A Warner & Swasey Universal Turret Lathe, 2½" cap. Bar Feed;
#3A Warner & Swasey Universal Turret Lathe, 4½" Hole thru Spindle; Chucking;
#3¼x36 Cincinnati-Acme full Universal Turret Lathe, Bar feed; SPD
#7 FOSTER Universal Turret Lathe, 2" Bar cap.
Brown & Sharpe #1, #2 Hand Screw Machines, auto wire feed, complete

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Adams-Farwell 12"
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Brown & Sharpe #4—48"
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King 42"—52" vertical

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16" Wolcott
16" Gould & Eberhardt cone
16" Gould & Eberhardt; S.P.D.
18" Gould & Eberhardt; S.P.D.
20" Cincinnati; cone
20" Gould & Eberhardt; S.P.D.
20" Lowell; V-ram; cone
20" Mattison; V-ram; cone
20" Smith & Mills
24" Gould & Eberhardt cone
26" Smith & Mills; cone
24" Cincinnati; cone
26" Smith & Mills; cone
24" Gould & Eberhardt; S.P.D.
24" Kelly; heavy duty; S.P.D.
34" Gould & Eberhardt; M.D.

PRESSES

Bliss #103 Automatic
Stoll #138B; OBI; Crank 7" stroke 48"x42" bolster
Stoll #79B Geared; 7" stroke 48"x36" bolster
Bliss #305 S.S. Geared 5" stroke 22x22" bolster
Maxams, dble crank 4" stroke 36"x24" bolster
Toledo #75; #14; Horn
Toledo 250 ton Coining
Toledo 100 ton Coining
Bliss #18; 19; 19B; 20; 21; 21½ Plain and Geared
V&O #12½ Dial Feed
Niagara #25 Arch
Williams & White Multiple Punch 10' long; 2½" stroke; 7" shaft

SHEARS & BRAKES

Dries & Krump 10' x 3/16, MD; SHEARS;
Dreis & Krump #167, 6'x3/8" M.D. Brake
DRIES & KRUMP 6' x 3/8 Apron BRAKES, MD
Stoll #142 — 42" x 16 ga; #236 — 36" x 14 ga
NIAGARA #748, 48" x 3/16 cap; (3)
Niagara #236 (2) Shear
Niagara #236, 36" x 14 ga; #136—36" x 16 ga
Niagara #16A Ring & Circle; 14 ga
Stoll #136; 16 gauge Shear

GRINDERS

#1 Landis 6x20 Univ.
#2 Brown & Sharpe 12x36 Univ.
#2 Brown & Sharpe 10x36 Univ.
#3 Landis 12x36 Univ.
#1 Fraser Universal
10x36 Norton Plain
12x36 Cincinnati Plain
8x24 Fitchburg Plain
#2 Norton Univ. Tool & Cutter
#1½ Cincinnati Univ. Tool & Cutter
#1 Greenfield Univ. Tool & Cutter
#2 Wilmarth & Morman Univ. Tool & Cutter
#3 Ohio Tool & Cutter
#2 Bath 12x36 Univ. Grinder
#6 Gardner Disc Grinder; B.B. 30"
#4 Badger Disc Grinder B.B. 12"
#14 Gardner Disc Dble. opposed B.B.
#3 Abrasive Surface Grinder
#3 Wilmarth & Morman Surface Grinder
#2 Brown & Sharpe M.D.
12x36 Pratt & Whitney Vertical
#6 Rivett Internal 14"x11"
#103 Rivett Plain
10" Persons Arter Rotary Surface
12" Heald Rotary Surface Grinder
14"x50" Norton Plain

SENSITIVE DRILLS, HIGH SPEED, B.B.

Avey #3; 2-spindle Aveymatic
Avey #2; 2-spindle 12" overhang
Leland-Gifford 2-spdle 10" overhang
Foote-Burt-Sipp 4-spdle; P.F.
Demco 4-spdle #2 M.T. (3)
Avey 2-spdle #2 M.T. 8" overhang
H&W 2-spdle #2 M.T. 8" overhang
Sipp 2-spdle #2 M.T. 8" overhang
Kern 2-spdle #2 M.T. 8" overhang
Avey #3 Single Spdle; Tapping Att. on spindle
Avey #2 Single Spdle; Tapping Att. on spindle
Fosdick #1; super speed
(2) Kokomo #3 M.T. 24x28 table
Allen 1-spdle #2 M.T. 7½" overhang
Sipp #2 M.T.; one spindle; comptable

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Pease 42" Blue Printer
Nilson 3/16, 4-slide Wire Former
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Niles Roller Leveller, 60"
Wheel Press, 350 ton
Spot Welders, 90-KW; 60-KW; 48-KW; 30-KW; 25-KW; 15-KW; 10-KW
Sleeper & Hartley BX Coiling Machine

FALK MACHINERY CO., INC.

Machinery Merchants

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(Continued from page 171)

PLANT SUPERINTENDENT or machine shop foreman—thoroughly experienced in machine shop, foundry, pattern shop and structural steel work. Location immaterial. PW-892, American Machinist, 330 W. 42nd St., New York, N. Y.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of American Machinist, published every other Wednesday at Albany, N. Y., for October 1, 1940.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared D. C. McGraw, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of American Machinist, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Editor, Burnham Finney, 330 West 42nd St., N. Y. C. Managing Editor, John Haydock, 330 West 42nd St., N. Y. C. Business Manager, W. E. Kennedy, 330 West 42nd St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw; Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 73 No. Country Club Drive, Phoenix, Ariz. J. Malcolm Muir & Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 140 Broadway, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

D. C. McGRAW, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.
Sworn to and subscribed before me this 27th day of September, 1940.
[SEAL] H. E. BEIRNE,
Notary Public, Nassau County. Clk's No. 93. N. Y. Clk's No. 974, Reg. No. 2-B-609.
(My commission expires March 30, 1942)

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Geared head, single pulley drive with motor in base. Three step cone with friction double back gears. Four step cone, single back gear.

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Will even furnish competent man to help you get started.

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Keyseater, #2 Baker.
Press, #55 Consolidated, 6" stroke.
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Gear Hobbers, #2 Barber-Colman, bench type.
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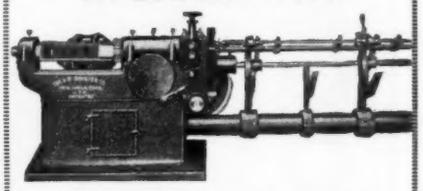

1—¾" SHUSTER WIRE STRAIGHTENING AND CUTOFF MACHINE
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Horizontal Boring Mills between two and three inches, ***Planers, Radial Drills,*** Blanchart type ***Vertical Grinders,*** ***Heavy Lathes, Gear Cutting Machinery,*** preferable motor driven tools or single pulley drive. Submit offer and photographs, details, illustrations and when available.

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3¼" Single Spdle. Gridley, Model L

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26" Barnes Sliding Head
Nos. 11 & 12 P & W Multiple
3½' Western Radial, M.D.
4' American Triple Purpose, SPD
6' American Triple Geared, SPD

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No. 1½ Landis Universal Cylindrical
No. 55 Heald Cylinder
No. 12 NEW G. & L. Tap
10"x36" Norton Cylindrical

LATHES

14"x 8' Seneca Falls Tool Room
14"x 8' Springfield, Gr. Hd., D.C.
18"x 9' Chard, Semi-quick change
18"x12' Whitcomb-Blaisdell, D.C.
20"x10' Hendey, Ty-bar, Q.C.G.
22"x20' Flather, L.C.G.
24"x12' American, Gd. Hd.
32—64"x11' Fay & Scott Gap, Q.C.G.
36—48"x14' Bridgeford Gr. Hd., M.D.

MILLERS

No. 1½ Knight Vertical
No. 3 B Heavy B & S Plain, SPD
No. 3 Cincinnati Vertical, P. R. T.
No. 4-B B & S Plain, SPD

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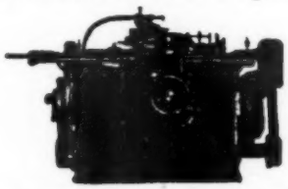

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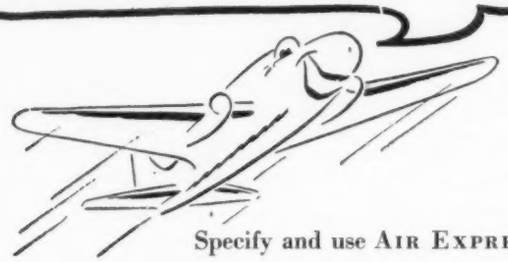

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Houghton & Co., E. F. Philadelphia, Pa.
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Dayton Rubber Mfg. Co., Dayton, Ohio

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
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Johnson Bronze Co., New Castle, Pa.

BUSHINGS, Bronze
Bunting Brass & Bronze Co., Toledo, Ohio
Johnson Bronze Co., New Castle, Pa.

BUSHINGS, Drill & Jig
Colonial Broach & Machine Co., Detroit, Mich.

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Mattison Machine Works,, Rockford, Ill.

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Meehanite Research Institute of America, Pittsburgh, Pa.

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Gisholt Machine Co., Madison, Wis.
Ready Tool Co., Bridgeport, Conn.

CASTINGS, Meehanite
Meehanite Research Institute of America, Pittsburgh, Pa.

CENTERING MACHINES, Automatic
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Jones & Lamson Machine Co., Springfield, Vt.

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De Laval Separator Co., New York, N. Y.

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Philadelphia Gear Works, Philadelphia, Pa.

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Bilgram Gear & Machine Works, Philadelphia, Pa.

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Jacobs Mfg. Co., Hartford, Conn.
North Bros. Mfg. Co., Philadelphia, Pa.
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CHUCKS, Lathe
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Heald Machine Co., Worcester, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
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CLOTHING, Safety
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CLUTCHES
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Union Twist Drill Co., Athol, Mass.

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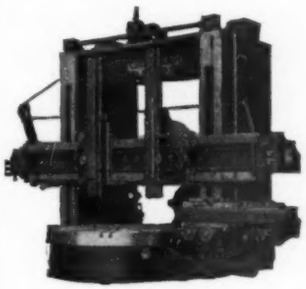

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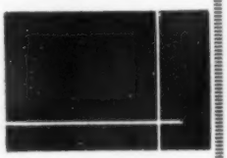

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General Elecrtic Co., Schenectady, N. Y.

CONNECTORS, Electric Cable
Graybar Electric Co., Inc., New York, N. Y.

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Square D Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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CONTROLS, Welding
Weltronic Corp., Detroit, Mich.

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Carboloy Co., Detroit, Mich.

CUTTERS, Brake Lining & Belting
North Bros. Mfg. Co., Philadelphia, Pa.

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Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Waltham Machine Works (small), Waltham, Mass.

CUTTERS, Keyseaters
Davis Keyseater Co., Rochester, N. Y.
National Mach. Tool Co., Cincinnati, Ohio

CUTTERS, Milling
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McCrosky Tool Corp., Meadville, Pa.
Machinists Tool Grinding Co., Chicago, Ill.
Michigan Tool Co., Detroit, Mich.
Modern Tool Works, Rochester, N. Y.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.
Wesson Co., Detroit, Mich.

CUTTERS, Pipe, Hand
Armstrong Bros. Tool. Co., Chicago, Ill.

CUTTING, Abrasive
Campbell, Inc., Andrew, C., Bridgeport, Conn.

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Etna Machine Co., Toledo, Ohio
Landis Mach. Co., Waynesboro, Pa.
Porter-McLeod Machine Tool Co., Hatfield, Mass.

CUTTING-OFF Machines, Abrasive
Campbell, Inc., Andrew, C., Bridgeport, Conn.
Porter-McLeod Machine Tool Co., Hatfield, Mass.

CUTTING-OFF Machines, Circular Saw
Porter-McLeod Machine Tool Co., Hatfield, Mass.

CUTTING-OFF Machines, Cold Saw
Consolidated Mach. Tool Corp., Rochester, N. Y.

CUTTING, Sheet Metal
Campbell, Inc., Andrew, C., Bridgeport, Conn.

DEALERS, Machinery (See Searchlight Section)
Aaron Machinery Co., New York, N. Y.
Adelphia Equipment Co., Philadelphia, Pa.
Atlantic Machinery Corp., New York, N. Y.
Botwinik Bros., Inc., New Haven, Conn.
Central Machine Tool Corp., Toledo, Ohio
Cincinnati Machy & Supply Co., Cincinnati, Ohio
Dony Machry. Co., D. E., Rochester, N. Y.
Duquesne Electric & Mfg. Co., Pittsburgh, Pa.
Eastern Machy. Co., Cincinnati, Ohio
Elyria Belting & Machinery Co., Elyria, Ohio
Emerman & Co., Louis E., Chicago, Ill.
Falk Machinery Co., Inc., Rochester, N. Y.
Guyan Machinery Co., Logan, W. V.
Hill-Clarke Mach. Co., Chicago, Ill.
Hyman & Sons, Jos., Phila., Pa.
Indianapolis Mach. & Supply Co., Indianapolis, Ind.
Iroquois Machy. Co., Buffalo, N. Y.
Lafayette Machy. Corp., Detroit, Mich.
Lang Machinery Co., Pittsburgh, Pa.
Marr-Galbreath Machy. Co., Pittsburgh, Pa.
Miles Machy. Co., Saginaw, W. S., Mich.
Morey & Co., Inc., New York, N. Y.
Nuttall, J., Philadelphia, Pa.
O'Brien Machy. Co., Phila., Pa.
Osborne & Sexton Machy. Co., Columbus, O.
Ott Machy. Sales Co., Detroit, Mich.
Riverside Machinery Depot, Detroit, Mich.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Simmons Mach. & Tool Corp., Albany, N. Y.
Standard Machinery & Supply Co., Inc., Boston, Mass.
Strong, Carlisle & Hammond Co., Cleveland, Ohio
Toledo Machry. Exchange Co., Toledo, Ohio
Wigglesworth Machinery Co., Cambridge, Mass.

DEMAGNETIZERS
Walker Co., O. S., Worcester, Mass.

DIAMONDS, Industrial
Crafts & Co., Inc., Arthur A., Boston, Mass.

DIE CASTING MACHINES
Reed-Prentice Corp., Worcester, Mass.

DIE CUTTING MACHINES
Harvey Mfg. Co., New York, N. Y.

DIE FEEDS
Dickerman Mfg. Co., H. E., Springfield, Mass.

DIE HEADS, Threading
Hill-Acme Co., Cleveland, Ohio

DIE-MAKING MACHINES
Haskins Co., R. G., Chicago, Ill.
Oliver Instrument Co., Adrian, Mich.

★ WHERE-TO-BUY DIRECTORY ★

DIE MAKERS SUPPLIES
Baumbach Mfg. Co., E. A., Chicago, Ill.
Danly Mch. Specialties Co., Inc., Chicago, Ill.

DIE SETS
Producto Machine Co., Bridgeport, Conn.

DIE SINKING MACHINES
Cincinnati Milling Mach. Co., Cincinnati, Ohio

DIE & TOOLS
Dickerman Mfg. Co., H. E., Springfield, Mass.
Hamilton Tool Co., Hamilton, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES
Firth-Sterling Steel Co., McKeesport, Pa.

DIES, Adjustable and Self Opening
Eastern Mach. Screw Corp., New Haven, Conn.
Errington Mech. Lab., Staten Island, N. Y.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.

DIES, Round Adjustable
Butterfield Division Union Twist Drill Co., Derby Line, Vt.
Card Mfg. Co., S W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.

DIES, Self Opening
National Acme Co., Cleveland, Ohio

DIES, Steel Marking
Noble & Westbrook Mfg. Co., Hartford, Conn.

DIES, Sub-press
Producto Machine Co., Bridgeport, Conn.

DISTRIBUTION PANELS
Square D Co., Milwaukee, Wis.

DIVIDERS
Brown & Sharpe Mfg. Co., Providence, R. I.

DIVIDING HEADS
Hartford Special Machinery Co., Hartford, Conn.

DOGS, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.
Ready Tool Co., Bridgeport, Conn.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Crafts & Co., Inc., Arthur A., Boston, Mass.
Carboloy Co., Detroit, Mich.
Desmond-Stephan Mfg. Co., Urbana, Ohio
Norton Co., Worcester, Mass.

DRILL GRINDING FIXTURES
Industrial Engineering Co., Inc., Minneapolis, Minn.

DRILL HEADS
U. S. Drill Head Co., Cincinnati, Ohio

DRILL STANDS
Black & Decker Mfg. Co., Towson, Md.

DRILLING AND TAPPING MACHINES Multiple
Bullard Co., Bridgeport, Conn.
Cosa Oversea Trading Corp., New York, N. Y.
Errington Mech. Lab., Staten Island, N. Y.

DRILLING MACHINES, Automatic and Semi-Automatic
Avey Drilling Machine Co., Cincinnati, Ohio
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Davis & Thompson Co., Milwaukee, Wis.
Kingsbury Mach. Tool Corp., Keene, N. H.

DRILLING MACHINES, Bench
Avey Drilling Machine Co., Cincinnati, Ohio
Delta Mfg. Co., Milwaukee, Wis.

DRILLING MACHINES, Gang
Avey Drilling Machine Co., Cincinnati, Ohio
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Cincinnati, Ohio

DRILLING MACHINES, Heavy Duty
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Consolidated Mach. Tool Corp., Rochester, N. Y.

DRILLING MACHINES, Horizontal
Kingsbury Mach. Tool Corp., Keene, N. H.

DRILLING MACHINES, Radial
American Tool Wks. Co., Cincinnati, Ohio
Carlton Mach. Tool Co., Cincinnati, Ohio
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Cleveland Punch & Shear Works, Inc., Cleveland, Ohio

DRILLING MACHINES, Sensitive
Avey Drilling Machine Co., Cincinnati, Ohio
Cosa Oversea Trading Corp., New York, N. Y.
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.

DRILLING MACHINES, Turret
Kingsbury Mach. Tool Corp., Keene, N. H.

DRILLING MACHINES, Upright Multiple Spindle
Avey Drilling Machine Co., Cincinnati, Ohio
Barnes Drill Co., Rockford, Ill.
Cincinnati Bickford Tool Co., Cincinnati, Ohio
Consolidated Mach. Tool Corp., Rochester, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.

DRILLING MACHINES, Vertical
Avey Drilling Machine Co., Cincinnati, Ohio
Leland-Gifford Co., Worcester, Mass.

DRILLS
Cleveland Twist Drill Co., Cleveland, Ohio
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Automatic
North Bros. Mfg. Co., Philadelphia, Pa.

DRILLS, Bench
North Bros. Mfg. Co., Philadelphia, Pa.

DRILLS, Breast
North Bros. Mfg. Co., Philadelphia, Pa.

DRILLS, Brick, Stone, Cement, etc.
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLS, Center
Cleveland Twist Drill Co., Cleveland, Ohio
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, New York, N. Y.

DRILLS, Chain
North Bros. Mfg. Co., Philadelphia, Pa.

DRILLS, Flat
Carboloy Co., Detroit, Mich.

DRILLS, Hand
North Bros. Mfg. Co., Philadelphia, Pa.

DRILLS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.

DRILLS, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio
North Bros. Mfg. Co., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.

DRILLS, Twist
Victor Machinery Exchange, New York, N. Y.

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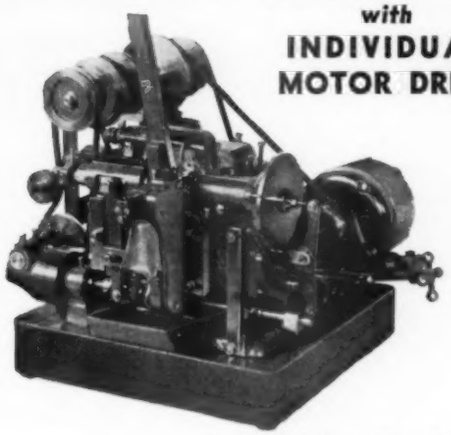

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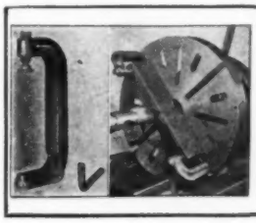

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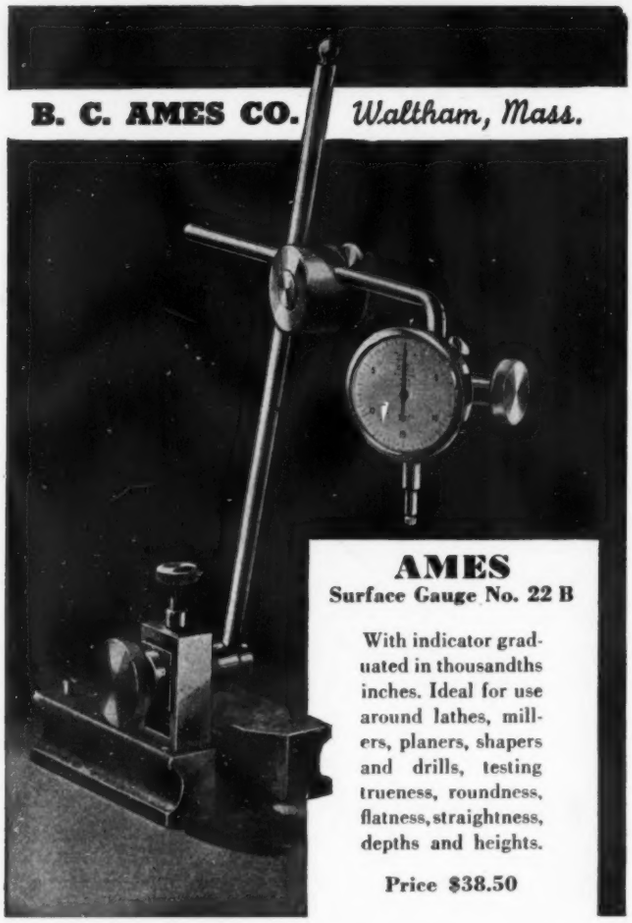

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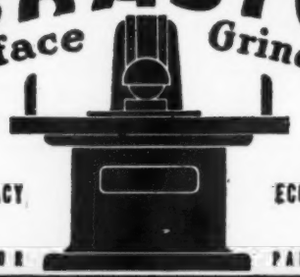

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National Twist Drill & Tool Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

ELECTRICAL INSTRUMENTS
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

ELECTRICAL SUPPLIES
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

ELEVATING TABLES, Portable
Hamilton Tool Co., Hamilton, Ohio

END MILLS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, Ohio
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

ENGINES, Die Set
Fairbanks, Morse & Co., Chicago, Ill.

ENGINES, Gas, Oil and Steam
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.

FACE PLATES
Brown & Sharpe Mfg. Co., Providence, R. I.

FANS, Electric
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FILES AND RASPS
American Swiss File & Tool Co., Elizabeth, N. J.
Nicholson File Co., Providence, R. I.

FILES, Rotary
American Swiss File & Tool Co., Elizabeth, N. J.

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Continental Machines, Inc., Minneapolis, Minn.
Harvey Mfg. Co., New York, N. Y.
Haskins Co., R. G., Chicago, Ill.
Oliver Instrument Co., Adrian, Mich.

FINGERS, Feed, Screw Machines
Hardinge Brothers, Inc., Elmira, N. Y.

FITTINGS, Hydraulic
Watson-Stillman Co., New York, N. Y.

FIXTURES, Grinding, Special
Industrial Engineering Co., Minneapolis, Minn.

FLAME CUTTING MACHINES
Air Reduction Sales Co., New York, N. Y.

FLEXIBLE SHAFT EQUIPMENT
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Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.

FORGING MACHINES
Hill-Acme Co., Cleveland, Ohio

FORGINGS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FORGINGS, Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

FORGINGS, Cold
Worcester Pressed Steel Co., Worcester, Mass.

FRICTION PULLEYS
Brown & Sharpe Mfg. Co., Providence, R. I.

FUEL Oil
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FURNACES, Brazing
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES, Direct Heat, Electric
Electric Furnace Co., Salem, Ohio
General Electric Co., Schenectady, N. Y.

FURNACES, Electric
Electric Furnace Co., Salem, Ohio
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FURNACES, Forging
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FURNACES, Gas
American Gas Furnace Co., Elizabeth, N. J.
Hones, Inc., Chas. A., Baldwin, N. Y.

FURNACES, Heat-Treating, Tempering and Annealing
Hones, Inc., Chas. A., Baldwin, N. Y.
Hoskins Mfg. Co., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FURNACES, Melting
Hones, Inc., Chas. A., Baldwin, N. Y.

FURNACES, Oil Fired
Electric Furnace Co., Salem, Ohio

FURNACES, Soldering
Hones, Inc., Chas. A., Baldwin, N. Y.

FURNITURE, Machine Shop
New Britain-Gridley Machine Co., New Britain, Conn.

GAGE BLOCKS
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.

GAGES
Brown & Sharpe Mfg. Co., Providence, R. I.
Sheffield Gage Co., Dayton, Ohio

GAGES, Comparator
Ames Co., B. C., Waltham, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Sheffield Gage Co., Dayton, Ohio

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Gage Co., Dayton, Ohio

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Sheffield Gage Co., Dayton, Ohio

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Crafts & Co., Inc., Arthur A., Boston, Mass.
Dickerman Mfg. Co., H. E., Springfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Sheffield Gage Co., Dayton, Ohio
Taft-Peirce Mfg Co., Woonsocket, R. I.

GAGES, Pressure
Brown Instrument Co., Philadelphia, Pa.

GAGES, Snap and Cylindrical
Brown & Sharpe Mfg. Co., Providence, R. I.
Dickerman Mfg. Co., H. E., Springfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Sheffield Gage Co., Dayton, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES Standard
Hanson-Whitney Machine Co., Hartford, Conn.

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Sheffield Gage Co., Dayton, Ohio

GAGES, Taper
Brown & Sharpe Mfg. Co., Providence, R. I.
Sheffield Gage Co., Dayton, Ohio

GAGES, Temperature
Brown Instrument Co., Philadelphia, Pa.

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GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Gage Co., Dayton, Ohio

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Sheffield Gage Co., Dayton, Ohio

GASOLINE
Standard Oil Co. (Indiana), Chicago, Ill.

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Gleason Works, Rochester, N. Y.

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Michigan Tool Co., Detroit, Mich.

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Adams Co., Dubuque, Ia.
Bilgram Gear & Machine Works, Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland, Ohio
Producto Machine Co., Bridgeport, Conn.

GEAR HOFFERS
Cosa Oversea Trading Corp., New York, N. Y.

GEAR LAPPING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.

GEAR MEASURING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.

GEAR TEMPERING MACHINES
Gleason Works, Rochester, N. Y.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland, Ohio

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Ganschow Gear Co., Chicago, Ill.
Grant Gear Works, Boston, Mass.
Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.

GEARS, Cut
Adams Company, Dubuque, Ia.
Bilgram Gear & Machine Works, Philadelphia, Pa.
Braun Gear Corp., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Earle Gear & Machine Co., Philadelphia, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow Gear Co., Chicago, Ill.
Gear Specialties, Inc., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston, Mass.
Hartford Special Machy. Co., Hartford, Conn.
James Co., D. O., Chicago, Ill.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Massachusetts Gear & Tool Co., Woburn, Mass.
Meisel Press Mfg. Co., Boston, Mass.
Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
Pittsburgh Gear & Machine Co., Pittsburgh, Pa.

GEARS, Non-Metallic
Bakelite Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago, Ill.
Massachusetts Gear & Tool Co., Woburn, Mass.
Perkins Mach. & Gear Co., Springfield, Mass.

GENERATORS, Electric
Century Electric Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.

GENERATORS, Motor
Janette Mfg. Co., Chicago, Ill.

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GREASE
Houghton & Co., E. F., Philadelphia, Pa.
Socony-Vacuum Oil Co., Inc., New York, N. Y.
Standard Oil Co. (Indiana), Chicago, Ill.
Tide Water Associated Oil Co., New York, N. Y.

GREASE, Lubricating
Texas Co., New York, N. Y.

GRINDERS
Delta Mfg. Co., Milwaukee, Wis.

GRINDERS, Bench
Black & Decker Mfg. Co., Towson, Md.

GRINDERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.

GRINDERS, Precision Thread
Jones & Lamson Machine Co., Springfield, Vt.

GRINDING HEADS
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINE ATTACHMENTS
Cincinnati Grinders, Inc., Cincinnati, Ohio
Norton Co., Worcester, Mass.

GRINDING MACHINES, Abrasive Belt
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Centerless
Cincinnati Grinders, Inc., Cincinnati, Ohio

GRINDING MACHINES, Chaser
Landis Mach. Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING Machines, Cutter & Tool
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Milling Mach. Co., Cincinnati, Ohio
Continental Machines, Inc., Minneapolis, Minn.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Geometric Tool Co., New Haven, Conn.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Le Blond Machine Tool Co., R. K., Cincinnati, Ohio
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Cylinder
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, Die
Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Heald Mach. Co., Worcester, Mass.
Landis Mach. Co., Waynesboro, Pa.
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston, Mass.

GRINDING MACHINES, Disc.
Besly & Co. Chas. H., Chicago, Ill.

GRINDING MACHINES, Drill
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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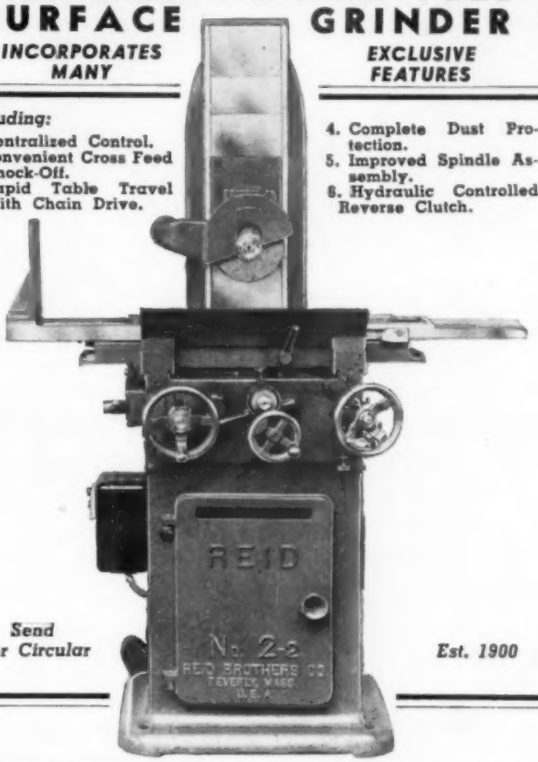

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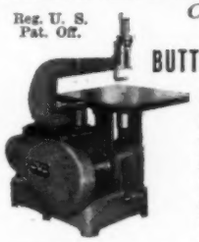

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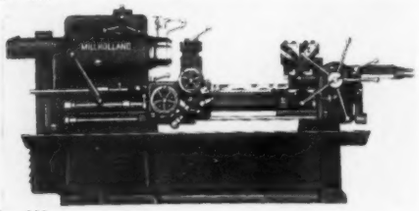

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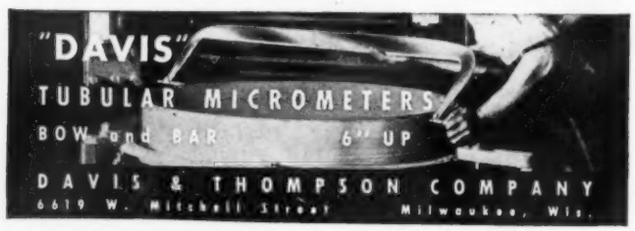

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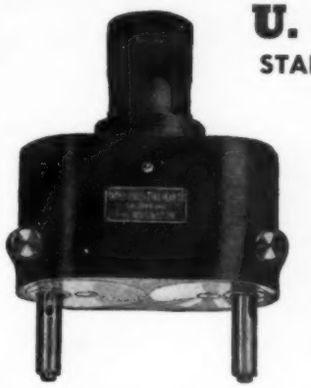

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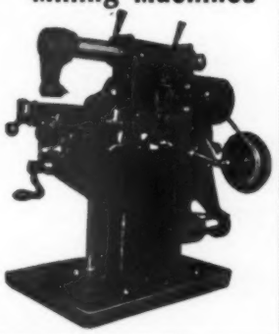

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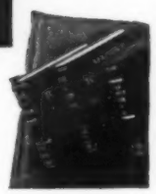

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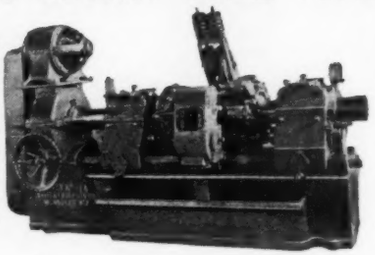

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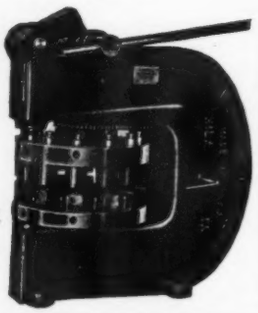

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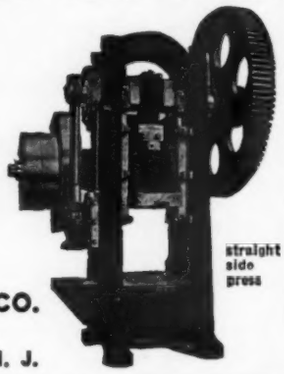

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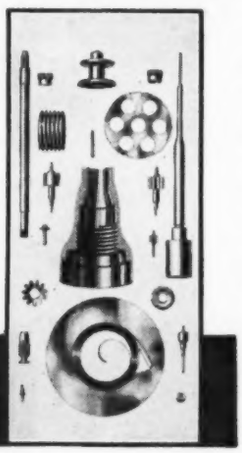

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De Laval Separator Co., New York, N. Y.

OIL GROOVING MACHINES
National Mach. Tool Co., Cincinnati, Ohio

OIL STONES
Norton Co., Worcester, Mass.

OILS, Cutting, Lubricating & Quenching
Houghton & Co., E. F. Philadelphia, Pa.
Socony-Vacuum Oil Co., Inc., New York, N. Y.
Texas Co., New York, N. Y.

OILS, Fuel
Texas Co., New York, N. Y.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

WHERE-TO-BUY DIRECTORY

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Marlin-Rockwell Corp., Jamestown, N. Y.

PIPE FITTERS TOOLS
Greenfield Tap & Die Corp., Greenfield, Mass.

PIPE PLUGS
Allen Mfg. Co., Hartford, Conn.

PLANING MACHINES
Cincinnati Planer Co., Cincinnati, Ohio
Cleveland Punch & Shear Works, Inc., Cleveland, Ohio
Consolidated Mach. Tool Corp., Rochester, N. Y.
Niles Tool Wks. Co., Hamilton, Ohio
Putnam Mach. Co., Hamilton, Ohio
Sellers & Co., Inc., Wm., Philadelphia, Pa.

PLATES, Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

PLATES, Steel
Ryerson & Sons, Inc., Jos. T., Chicago, Ill.

POLISHING AND BUFFING MACHINES
Continental Machine, Inc., Minneapolis, Minn.
Haskins Co., R. G., Chicago, Ill.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Machine Co., New Britain, Conn
Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

POLISHING GRAINS, Abrasive
Carborundum Co., Niagara Falls, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., Worcester, Mass.

POTENTIOMETERS
Brown Instrument Co., Philadelphia, Pa.

PRESS FEEDS
Dickerman Mfg. Co., H. E., Springfield, Mass.
V & O Press Co., Hudson, N. Y.

PRESSES, Arbor
Sheldon Machine Co., Chicago, Ill.

PRESSES, Drop Forging
Niagara Machine & Tool Works, Buffalo, N. Y.

PRESSES, Foot and Hand
Niagara Machine & Tool Works, Buffalo, N. Y.

PRESSES, Forcing
Oilgear Co., Milwaukee, Wis.
Watson-Stillman Co., New York, N. Y.

PRESSES, Forging
Hill-Acme Co., Cleveland, Ohio
Lucas Mach. Tool Co., Cleveland, Ohio

PRESSES, Hydraulic
Baldwin-Southwark Division of Baldwin Locomotive Works, Philadelphia, Pa.
Oilgear Co., Milwaukee, Wis.
Watson-Stillman Co., New York, N. Y.

PRESSES, Power
Clearing Machine Corp., Clearing, Ill.
Cleveland Punch & Shear Works, Inc., Cleveland, Ohio
Niagara Machine & Tool Works, Buffalo, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

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Cosa Overseas Trading Corp., New York, N. Y.
Morey Machinery Co., Inc., New York, N. Y.
Reed-Prentice Corp., Worcester, Mass.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.

PULLERS, Wheel, Gear, Shaft, etc.
Owatonna Tool Co., Owatonna, Minn.

PULLEYS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dayton Rubber Mfg. Co., Dayton, Ohio
Johnson Mach. Co., Carlyle, Manchester, Conn.

PULLEYS, V Belt
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PUMPS, Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PUMPS, Hydraulics
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Chicago, Ill.
Oilgear Co., Milwaukee, Wis.
Watson-Stillman Co., New York, N. Y.

PUMPS, Lubricant
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Chicago, Ill.
Ruthman Mach. Co., Cincinnati, Ohio

PUMPS, Oil
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Chicago, Ill.
Ruthman Mach. Co., Cincinnati, Ohio

PUMPS, Power
Fairbanks, Morse & Co., Chicago, Ill.
Watson-Stillman Co., New York, N. Y.

PUNCHES, Center & Hand
Lufkin Rule Co., Saginaw, Mich.

PUNCHES, Power
Cleveland Punch & Shear Works, Inc., Cleveland, Ohio
Mitts & Merrill, Saginaw, Mich.
Niagara Machine & Tool Works, Buffalo, N. Y.
Oilgear Co., Milwaukee, Wis.
Ryerson & Sons, Inc., Jos. T., Chicago, Ill.
Wiedemann Mach. Co., Philadelphia, Pa.

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Kent-Owens Machine Co., Toledo, Ohio

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Hoskins Mfg. Co., Detroit, Mich.

PYROMETERS, Optical
Brown Instrument Co., Philadelphia, Pa.

PYROMETERS, Recording
Brown Instrument Co., Philadelphia, Pa.

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Gisholt Machine Co., Madison, Wis.
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Pratt & Whitney Div., Niles Bement Pond Co., Hartford, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

REAMERS, Solid
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Greenfield Tap & Die Corp., Greenfield, Mass.
Holman Reamer Co., Manchester, Conn.
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Wesson Co., Detroit, Mich.

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Van Norman Machine Tool Co., Springfield, Mass.

RECTIFIERS, Electric Power
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

RECORDERS, Temperature
Brown Instrument Co., Philadelphia, Pa.

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General Electric Co., Nela Park, Cleveland, Ohio

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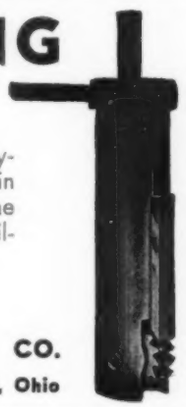

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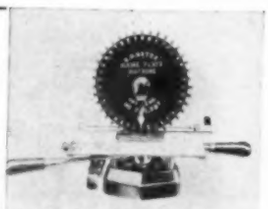

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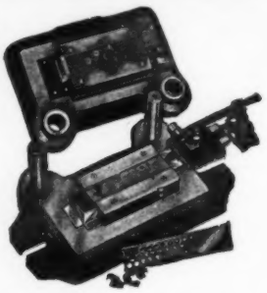

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Warner & Swasey Co., Cleveland, Ohio

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Noble & Westbrook Mfg. Co., Hartford, Conn.

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Carpenter Steel Co., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
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Wyckoff Drawn Steel Co., Pittsburgh, Pa.

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Firth-Sterling Steel Co., McKeesport, Pa.
Ryerson & Sons, Inc., Jos. T., Chicago, Ill.
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Wyckoff Drawn Steel Co., Pittsburgh, Pa.

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Firth-Sterling Steel Co., McKeesport, Pa.
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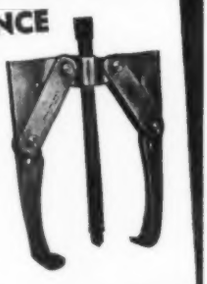

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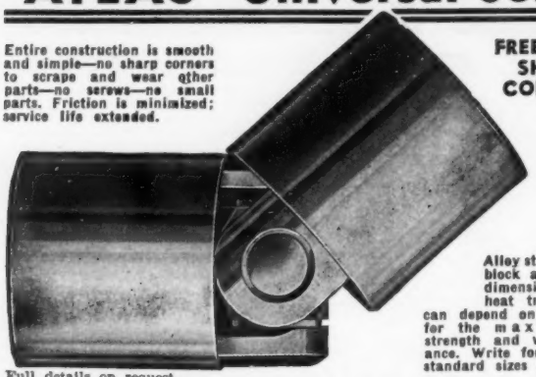

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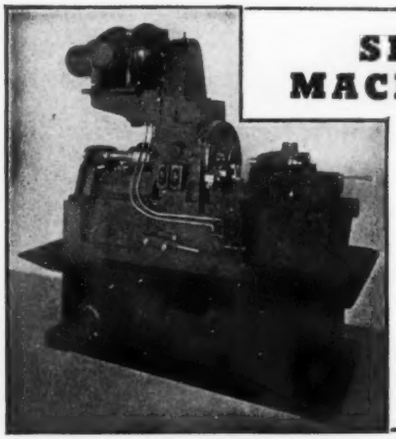

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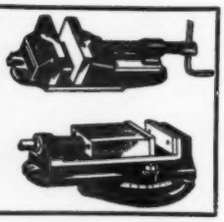

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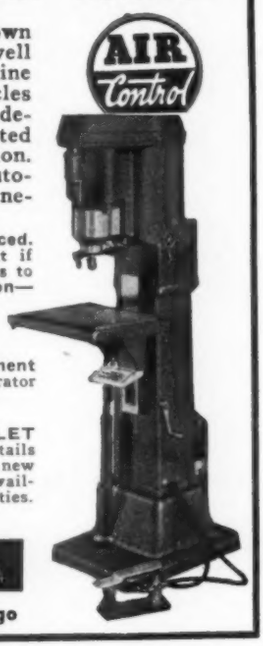

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